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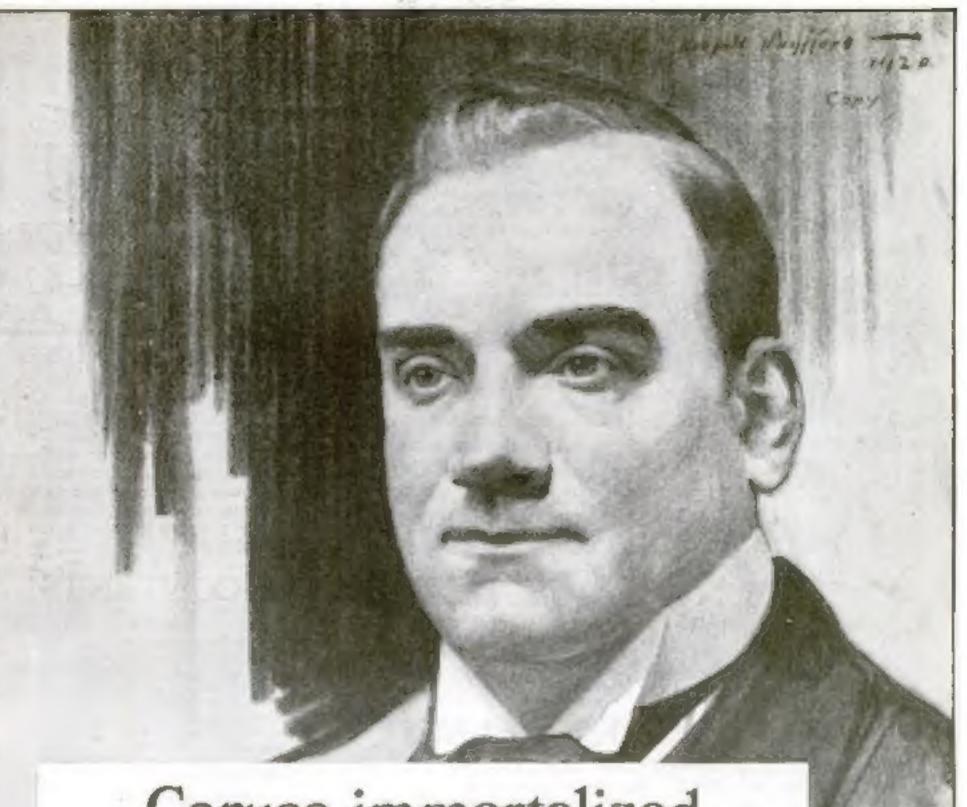


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Popular Science Monthly

FEB., 1921 Volume 98-No. 2

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Copyright, 1921, by the Modern Publishing Company Portura Science Monthly is insied monthly. Vearly subscription in the United States, \$3.00. Canada, \$3.50. Fareign, \$4.00. Single copy, 25 cents.

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New York City

How In One Evening I Learned The Secret of Drawing

NOM boyhood, I have always wanted to draw things. I suppose there are hundreds of young fellows who feel the same way as I did. I often said that if it were pos-

He was drawing little pictures

sible, I should choose commercial art as a profession. It was not only the big salaries and independence enjoyed by artists and cartoonists that appealed to me, it was the fascination of the game itself.

paper cartoonist, after

years of practical work-ing experience, has de-

clutionized the entire theory of drawing It corner that drawing can be easy for som as writing. Out of

as writing. Out of work a day experience. Mr. Lederer places this the three Big Secret of Drawing to all.

But I could hardly draw a straight line. My friends used to have laughing hysteries at my attempts to sketch things.

One morning, as I was coming into town on the eight o'clock train, I met Larry Stafford. I had come into town with him every day for years, usually passing the time discussing the morn-

But this particular morning he

had a pad and pencil in his hand. He was drawing little pictures of things Mr. Charles Ledeter. that looked like a series of the well-known newssmall animals.

"What on earth are you veloped one great simdoing?" I asked in amaze- ple rate for marries in all branches of comment.

Larry smiled "Don't be amazing series has re-

Larry smiled. "Don't be afraid, I am quite sane. These little pictures are part of a scheme of mine. I am illustrating an idea. They are supposed to be a graphic representation of a deal I am putting over. They speak louder than words."

I watched him, -amazed to see that he drew very well indeed. As he proceeded, and the drawings became more life-like, my curiosity aroused-I asked him about it-

"Why, I am surprised that you ask me?" he answered. "Look how easy it all is," he quickly sketched a few other figures and grinned at my amazement.

"There is just one little secret of the whole thing, Walter," he added. "I never drew before in my life, and you see, these little sketches really are not bad, are they? You have always wanted to draw, and even if you don't become an artist, you will find it a mighty convenient thing to know. This secret makes drawing as easy as writing. Let's get together this evening and I'll show you how simple it is. I'll give you a little lesson,"

The Greatest Surprise of My Life

That night I was associahed to learn that there was but One Great Rule that covered

By Walter Sayden every sort of drawing. I mastered this rule in just fifty minutes, and p that I could draw. Think of it! It was almost like magic. I had pever before been able to draw a recognizable object. At this time I was a salesman, so that the only time that I had to practice and

apply this secret, this Rule,

My First Real Drawing

One day I was talking with a buyer. Remembering Larry's "idespictures," I drew some figures to illustrate the point I was trying to establish. He looked at the pictures and caught my idea at once. Before I left he gave me a larger order than I had over before received from him. My pictures had put my idea over.

This worked no well, that I tried it again several times, in fact—and each time I got the same results. My pictures seemed to make a stronger appeal than my words, and my sales increased tremendously.

But that was not all. Two weeks later. I overbeard a conversation that struck me as I wrote it down, illustrated it and just for fun, sent it to one of the

A few days humorous weeklies. later, to my great surprise and pleasure. I received a check from the art editor and a request for more consributions.

From that time on, I sent is little sketches and jokes, more or less regularly. A few months ago, I received an offer which startled me-The magazine for which I had been drawing wished to take one on the regular staff at a much greater salary than | was then making.

My love of drawing came strongly to the front and, needless to say, I accepted at once, and the first thing I did was to tell Larry Stafford, what his idea had led to. When he heard that I was actually a successful artist on a real magazine be gasped with amazement.

I told him how the same One Great Rule of drawing which had made it easy for him to draw had meant even more to me-and how this simple home-study course by a famous artist. Charles Lederer, which we had gone over that evening, had given me the secret which had meant so much.

Larry laughed at my enthusiasm, but admitted that such a remarkable success as mine was enough to make a man a bit optimistic.

Easier than Learning to Operate a Typewriter

Through this amazing system, drawing can be fought as easily as anything else. In his simple, home-study course a worldfamous cartoonist. Charles Lederer, teaches you to draw just as a business school teaches you to keep books, or operate a typewriter or write shorthand. But it is a hundred times simpler than any of those accomplishments.

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The most functioning Business in the World

after all. Everyone wants to sell his work, and that is just what you can do, with Mr. Lederer's great secret.

Don't misundermand, I am not praising myself. The point is this,—if I, who never was able to draw at all, could achieve this really remarkable success, others can do the same, or better,

See for yourself, send for the course and my it out. If you can draw at all you will probably get along even faster than I, and you will find modern commercial art the most fascinating and delightful work imaginable. Remember, that opportunities a this uncrowded held are volimited. There is a constantly growing demand for cartoon-ists and illustrators. If you like to draw, or if you think that you would like to draw. don't miss this wonderful opportunity to learn in an evening or two of your spare time.

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We want you to prove to your own satisfaction the tremendous value of Mr. Lederer's discovery. It will not cost you one pensy. We want you to examine the Entire Course at our expense for five days. If you will just fill out the coupon below, detach it and mail it to us, we will gistly send you the complete course for your approval. We feel sure that when you see the surprising simplicity of this method you will approve the surprising simplicity of this method you will agree with up that it is the greatest discovery ever made in this field

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But act AT ONCE. Learn to draw-whether or not your aim is commercial art. It is a big disclose to you the whole secret. Detach the coupon and mail TODAY.

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Note how other commodities have seated to price store the zest days of the war. Nearly everything has doubled or trebled in price. But the Oliver set for 126 less than before the war! That shows the economy of our maker-to-user page.

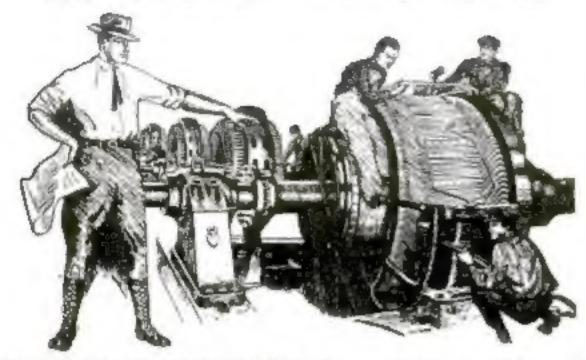
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"MEN ONLY"

All Men READ THIS!

Every man, sometime in his life, has the problem before him: "What Shall I Do for a Living?" "What Business Will I Follow?" That is the question for all real red-blooded manhood to solve. All young men want to try their hand at what they like to do, to be their own boss, and to spend their own money, to say: "I made my own money"—not that Dad gave it or left it to me. Your Dad started out himself: He made good. So can you, if you will follow what you like.

If you like the farm, GET ONE! But learn how to run it scientifically. Run it by machinery and cut out the hard work. Now if you want to be an auto mechanic, Garage owner, Battery man, Vulcanizer, Tractor engineer, or to be a Certified auto mechanic, or if you want to own your own business, leave the farm to the boy who likes it, because all the WORLD will not make a farmer out of you. Men always SUC-CEED at what they LIKE. This world is run by young men who want to be their own boss, who voted as they thought right, not as their fathers voted. That is American Manhood?

Young men mechanically inclined, made the automobile business what it is today. They run, build, repair eight million automobiles in the United States and make millions for themselves, wast to ask you a question. WHAT DO YOU LIKE TO DO HEST? WOULD YOU RATHER WORK ON MACHINERY THAN ANYTHING ELSE IN THE WORLD? ARE YOU MECHANICALLY INCLINED? If you are WRITE ME. I will tell you about men whom I have taught, who two years ago were shucking corn at three dollars a day. They are now business men, making from five hundred to a thousand dollars a month. Some of these were cow punchers, some clerks in a grocery store, some telegraph operators, in fact, they were from all lines of work, but they used their manhood and followed their mechanical inclinations and are today their own boss. I remem-ber Haroki Roberts, a farmer boy, 19 years old who two years ago, convinced his father that he did not like farming and his father was fair-

minded enough to help
the boy learn the right
trade. ALL REAL
lathers are very glad
to help their boys if
the boys will tell
the boys will tell
the y
want to
do. Harold today

is a business man in Illinois, making one thousand dollars a month. His Dad cannot do that well after thirty years' experience on the farm. Half the men in the world are mishts, working at something they do not like,

Maybe, you have always wanted to work on the autonobile or gas engine but never had the chance. WRITE ME! I have solved the troubles of thirty thousand men. I have one sufficient dollars invested in a building and equipment for you to use. I own the largest automobile school in the world and I am the "DADDY" of the business, although I am only 36 years of age. I have taught more men the automobile business than any other man in the world. Thousands of men have written to me, told me their ambitions, and have asked me to belo them. Write me, tell me your ambitions. Do not waste your life, but be a LIVE ONE. BUCK UP! Get into business, one you are fitted for.

I have written a book on the Automobile and Tractor business, just like I am writing this, a good sensible talk, filled with facts, pictures, letters which tells and shows how other boys have made good and how I teach them to make good, I want you to tell use your real thoughts. about the future. I am "E. J." to over thirty thousand men in the United States. I helped them. Write me now and you and I will figure it out together. Remember you are the one to earn your bread and butter. Why not make your work play by working at what you like, If you like machinery, if you are mechanically inclined, and are game, are not afraid of working in grease, gasoline, you and I will get along together fine. I cannot teach any man a trade if he does not like his work. If you don't like to work in the dirk, grease, among machinery, you are not mechanically inclined. If you are, write me, and write me NOW! Don't put it off, but get busy, get your penell, fill out the coopon in the corner, and mail it to me for my book. This is the only school in the world where you can go into his office and call the president "E. J." and not get expelled from school have no professors. Our teachers are all real, redblooded men wbo know their business, who teach the Sweeney System

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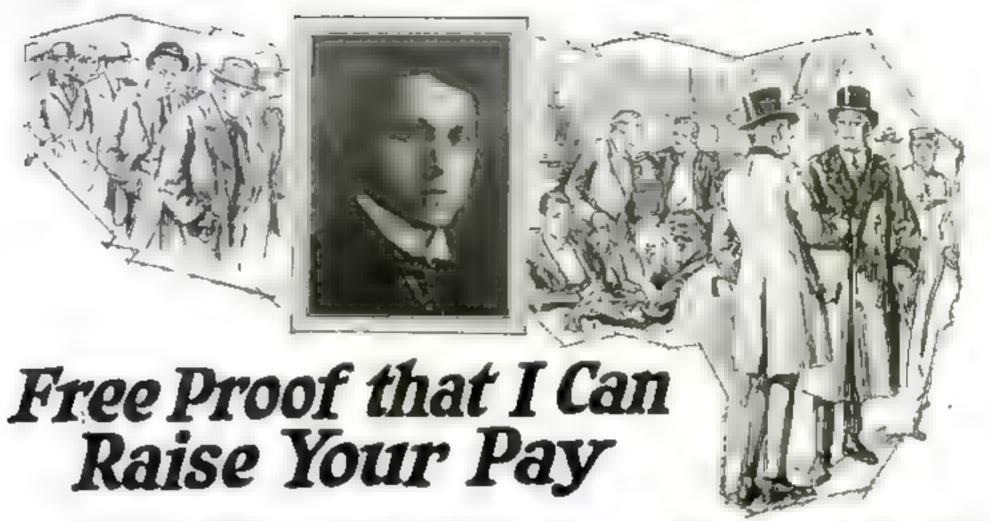
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No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make \$100-\$200, and in one case so high so \$2,000 weekly. I am willing to prove this entirely at my risk and expense.

ET'S have a little chat about getting ahead—you and I. My name is Pelton.
Lots of people call me "The Man Who Makes Men Rich." I don't deny is. I ve done it for thousands of people-lifted them up from poverty to riches.

I'm no genius-for from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had facure stalk me around and hoodon everything I did. I ve

known the bitterest hand of warr But today all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy-health, happiness and friendship. Few people have more of the blessings of the

world than I.

I I was a simple thing that jumped me up from poverty to riches. As I've said, I'm

no genius. But I had the good fortune to know a genius. One day this man told me a secret. It had to do with getting sheari and growing rich. He had used it hymself with remarkable results. He said that every wealthy man knew this "eccret"—that is why he was

I used the "secret." surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret

At first I couldn't believe my sudden change in fortune. Money actually flowed in on ma. I was thrilled with a new sense of power. Things I couldn't do before become as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me Prosperity became my partner Since that day I've never known what it is to want for money, friendship, happeness. health or any of the good

throgs of life. That "secret" surely made me rich in every sense of the A Few Examples Personal Kaparteness

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Super regal Power of Well not support has a majoral fato. \$1150 in \$1,560 in majoral filter. \$150 in \$1,560 in majoral filter. \$1.50 in \$1 From \$100 to \$3,000 a Month

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Execution Will before he among a re

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\$1000 the first print and with a

\$1500 prize for the best splerionan
thin a the state Privace Leable

A III A E F Flance

MY audden rise to riches naturally sur-prised others. One by one people rame to me and asked me how I did it. I told them. And it worked for them as well as it did for

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere pothing. That's merely playing at it. In one case I took a rank failure and in a lew weeks had him earning as high as \$2,000,00 a week. Listen to this

A young man in the East had an article for which there was a nation wide demand. For twelve years he "puttered around with a barely clung out a living. Tislay this young man is worth \$200,000. He is turkling a \$25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing,

traveling whenever the mood strikes tom. His income is over a thousand dollars a week.

In a little town in New York lives a man who a few years ago was put of by a lowler knew him From the time he was 14 he had worked and slaved-and at sixty To was looked upon as a faringe. We hout work in do to to be because friends with an invalid son to support, the outlook was pitchy black

Then he learned the 'secret In two weeks he was in business for humself. In three months his plant was working ought and day 12 h | witers | 12a x g 1416 toe prints were \$20,000. Daing 191 the prints ran close to \$40,000. And this genial 64 year oung man is en line property and converts he bardreamed would ever be his

COLLD tell you thousands of a far instance. By there a no need a do this as I in wong to tell von the servet Then you can not it work and see what it will do for

I dou't claim I can make you rich over night. Maybe I canmaybe I can't. Sometimes ! have failures—everyone has. But I do claim that I can bely 40 out of every 100 people if they will let me.

The point of it all, my friend is that you are using only about one-tenth of that wonderful brain of yours. That's why you haven't won The in the uneser more tentlia of your brain into action and you'll be amused at the almost instantaneous results.

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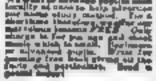


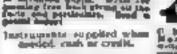
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An official of one of the big railroads says, in a message to his workers. "While this is being written there are at work in humble positions on the Erie, many men who in future years will be the bosses—the superintendents, the master mechanics, the foremen, the managers, the auditors, the assistant managers. Why not aspire to be one of these?"

Every normal man has within him the ingredients that will make him a success. But the man who is without special training for the work he wants to do, is just as surely handicapped as though he had neither hands nor feet. And not until he does get the special training and is earning more money will be fully realize the close relation that exists between special training and production of wealth.

The demand for men with special training is growing daily. Business can not afford to burden its pay-roll with men of no initiative or ability. Business wants men who can be promoted, who can hold responsible positions, who will be respected by their associates. The untrained man far from being looked up to, is often the object of ridicule to thise with whom he comes in contact. Ignorance is inexcusablethere is no need for it.

Keep in mind that your life is the most important life ever lived as far as you are concerned. So if adverse circumstances have kept you from getting the training necessary for the job you want don't be discouraged. It is not too late to get the special training and to prepare yourself for success in your

chosen line. Drop us a line. Tell us of your troubles, let us know your arm in life and what kind of work you would like to

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He Has a Most Remarkable **Knack for Reading Faces**



How Tom Rutherford Makes \$18,000 a Year!

L. Hamilton McCurtistik

I hadn't seen Tom Rutherford in nearly 10 years. When you consider that we had been pals at college, you can imagine how de ighted I was to hear his cheery voice come singing over the triephone.

He was on one of his big swings over the eastern territory and he wanted to know if I wouldn't come down and ent dinner with him at his hotel.

I found him to be the same old Tomolder of course—s trife gray around the temples-perhaps a little beener of eyobut all in all the same old Tom. Success hadn't turned his head one bit and I felt no besitancy in asking him how it was that he had been so succession

"I can sum it up in five words," be said quickly -"The shirty to read men. I can

tell within three minutes after i meet a man the kind of man he is. I can tell if he is bonest, I can te l if he is kind, if he is open to remon or if he is obstinute, if he is dependable, if he is careful or if he is careless. His eyes tell me one thing his nose something rise-his mouth, his laps, his forehead, his profile, his ears, every feature in fact has a never failing message to the skilled observer.

"Everybody reads character. Almost everybody can tell a clergyman reason why I am earning \$12,000 a year. from a ruffian or a bricklayer from a musician just by looking at their faces. But the amportant thing is to be able to read character when the lines are not so clearly

"You know I had no more ability to start with then any one else. But one day I beard of a very rich man named L. Hamilton McCormick who had been making a life-time study of Character-as revealed in the face. I determined to visit him in his home and I did. I found him to be one of the most charming-most unusual men I have ever met.

"For forcy years he had been making a study of CHARACTEROLOGY - not for money, for he is many times a millionaire, but through a desire to establish this study as an exact science. His study of types had taken him all over the world. After a lifeterne of effort be had formulated certain definite rules for reading character. When he told me that any one who studied these rules could read character my embusians.

knew no bounds. We got to be fast friends and I personaled him to let me read the manuscript of this monumental work.

"From then on my success in business was assured. People marreled at my ability to swing conferences to my point of view-to make friends-to sell prospects who had been listed so impossible. It was all due to my ability to read men.

"For several years I have been urging Mr. McCoemick to publish his rules for reading character. But always he would shake his bend and say kindly-'Not yet, my dear ar I must be ten times sure of every word before I offer this work to the public.

"And now at last, CHARACTEROLOGY has been published. In it you will find

every rule for reading character that has made my business and eneral life so successful. You, too, can become an expert reader of character if you study the rules laid down by Mr. McCormick.

"You will find this not only the most interesting work you have ever read but the most profitable. It is something that you can use every day of your life. I firmly believe-in fact I know-that my ability to read men in the one big

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THE SATURDAY EVENING POST, in its issue of October 9, tells the story. He was a retiring fellow-rarely ever asserted himself. Didn't have much to say. He blushed whenever a girl spoke to him.

But he did a lot of thinking and away back in his mind something whispered the old message 'Knowledge is Power' So he began using his spare hours in studying the job above him. As he studied, he not only gained knowledge that enabled him to do his work better but his concentrative powers and his confidence increased.

One day the foreman didn't turn up. The superintendent and the general manager came into the shop discussing the foreman's sudden death. "Where will we find a man to take his place?"

And then like a flash, the modest young man realized the power he had been accamulating. With new-born confidence, he stepped before the bosses and explained that for two years he had been quietly preparing for a bigger job -that he could handle the foreman's work.

Said they together: "You are foreman!"

America everywhere needs men like this earnest young man-men of vision who see that what they put into their heads, through the study of practical subjects, is the best-paying investment, for it brings not only more money but greater opportunity, larger responsibility, and bigger manhood

Many thousands of men in high positions today look back with satisfaction to a spare-hour course completed with the aid of earnest Y. M. C. A. instructors. Last year the Y. M. C. A. gave instruction to more than 107,000 men and boys who believed in such use of their spare. Tonay, with correspondence instruction added to their day and evening classes, the Y M C A Schools are teathing more men than ever before. The list below suggests a few of the 180 courses now offered-something for every ambitious man

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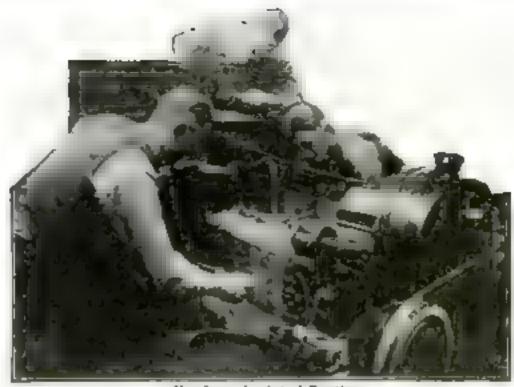
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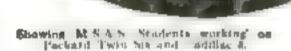
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How Did Columbus Discover-America?

OLUMBUS was not a happy-go-lucky adventurer. He was fired by the spirit of ducovery, the spirit of research.

A man who engages in research never knows what he will discover. So it was with Columbus. He discovered among other things the variation of the compais needle. He opened up an entirely new continent. He was the first to acquaint Europe with the strange new people, animals and riches of the western world. He conducted research on a large scale.

There is a greater similarity between Columbus' voyage of discovery and laboratory research than may be supposed. The man in the laboratory who tries to discover the "why" of things is a Columbus. He substitutes facts, knowledge, for guesses and plaumble theories. And, like Columbus, who observed strange deflections of the compais needle, he discovers phenomena undreamed of before.

Every investigation conducted in the Research Laboratories of the General Electric Company at Schenectady, New York, is a voyage of discovery. Where will it end? What will be disclosed? No man can tell. But year in and year out the very constitution of matter is studied, and new principles are revealed that make the world a better place to live in.

The modern vacuum and gas-filled tungsten lamps, which give three and four times as much light for the same money as the old carbon filament lamps, were developed when the scientists in the Research MAZDA, then, is a Research Service Mark It stands

Laboratories tried to find out why tungsten could not be handled like other metals

and what were the conditions under which hot filaments glowed in the best vacuum that could be produced in a glass bulb. The world was enriched by new facts, new knowledge. And the commercial product was the cheapest light thus far produced.

It is not a purely business purpose that dominates the Research Laboratories, but the spirit of inquiry, the dence to increase human knowledge. Yet commercially valuable results always follow when research is thus conducted,

Through MAZDA Service the lamp industry learns of the work done in the Research Laboratories when it has a commercial application through MAZDA Service the Research Laboratories at Schenectady learn of discoveries of possible value made in other institutions and of the technical difficulties encountered by lamp manufacturers. So, MAZDA Service is both collector and distributor of information. It has its nerves in laboratories where lighting is studied and in factories where lamps are made. When a new discovery is made either in the Research Laboratories at Schenectady or elsewhere, the industry is mire to benefit by it through MAZDA Service,

There is only one MAZDA Service, but there is more than one manufacturer of MAZDA lamps. Hence a lamp is marked MAZDA because its manufacturer is entirled to receive the benefit of MAZDA Service, which is centered in the Research Laboratories at Schenectady,

for progress made by scientific research in the Laboratories at Schenectady.

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Popular Science Monthly

Waldemar Kaempffert, Editor

February, 1921; Vol. 98, No. 2 25 Cents a Copy; \$3 a Year



Published in New York City at 225 West Thirty-ninth Street

Measuring the Emotions

A way to test a man's fitness for his task

By P. J. Risdon

English correspondent of the Popular Science Monthly

THE resistance that the human system offers to the passage of an electric current varies according to the emotional condition of a subject. As mental disturbance increases, this resistance is reduced and permits of the passage of an increased current.

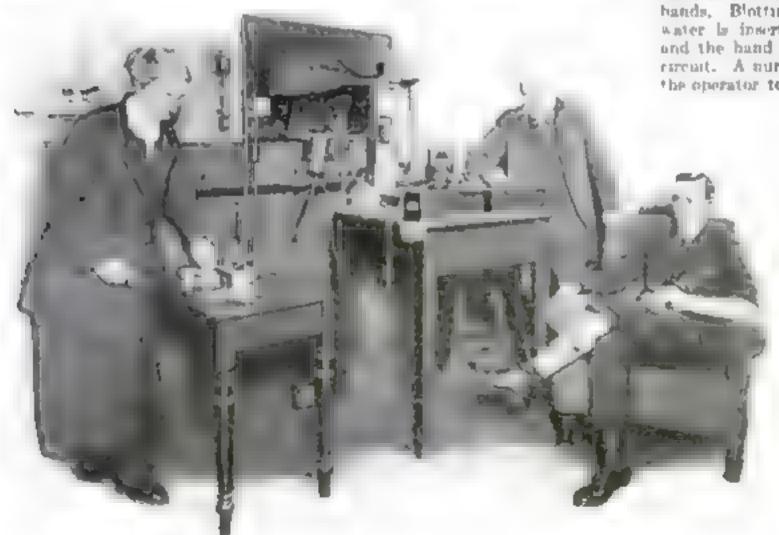
Dr. A. D. Waller, the director of the physiological laboratory of the University of London, applied the principle in an invention that actually measures the emotions and that should be of considerable value to medical men in diagnosing mental and nervous diseases.

The apparatus comprises a system of electric wiring connected with a galvanometer (an instrument that measures the effect of variations in an electric current by which it is influenced). The variations are recorded by means of a delicately balanced needle or pointer; a tiny reflector moves in sympathy with the needle.

A light is concentrated on the reflector. As the reflector moves, a

beam or head of light retected from it travels along a graduated scale. For convenience the scale may be placed in front of a mirror, so that the operator and subject may both see the movement.

In the electric circuit is a pair of Lechanche cells and another small battery. A pair of siuminum disks trailed electrodess, wired up to the circuit, is attached to the hand of the subject, one being placed against the pairs and the other on the back of the hand and held in position by rubber hands. Blotting-paper soaked in salt water is inserted between the disks and the hand to insure an unbroken circuit. A number of switches enable the operator to vary the resistances in



Aluminum electrodes are attached to the hand of the subject—one against the palm, the other on the back of the hand. These are electrically connected with a reflecting galvanometer

Variations in the electric current are recorded by means of a delicately bolanced needle with which a tiny mirror moves in sympathy. The light is concentrated on the mirror. As it moves, the beam reflected travels along a graduated scale.

Lunge at the subject with a pin with the evident intention of pricking him, and the light moves supply to the very end of the scale.

the circuit and the amount of current flowing.

Now, the emotional response of different persons varies greatly, and indeed the response of any one person varies considerably according to the time of day or night and to his or her health.

Consequently the apparatus has to be calibrated or set so that at the commencement of operations the bead of light is at zero on the scale while the

aubject is perfectly quiet and free from excitement and disturbing influences.

I cannot do better than relate here the tests to which Dr. Waller subjected me.

Upon entering the laboratory, I noticed that the electrician's hands were badly scarred, and questioned him as to whether it was Dr. Waller's doing. He made a motion of his head in the affirmative.

I was seated in a comfortable arm-

"Compose yourself and smoke," said the doctor.

Meanwhile the electrodes were fastened on my left hand and the instrument was calibrated until the spot of light was stationary at zero.

Anticipation Is Worse than Reality

Without the slightest warning, Dr Waller then picked up a pln about four inches long and made a lunge at my right hand without touching it. The bead of light moved right to the end of the scale and very slowly returned.

Have you ever heard a Klaxon horn sounded in a laboratory? That was what next happened, with the same result.

Then Dr. Waller really did prick

my hand with the pin; but the effect was less pronounced than when he pretended to do so.

Such is the sense of duty to one's editor, and so ready to suffer must a correspondent be. that I positively asked to be burned so as to record the effect. Twice Dr. Waller fumbled about with matches and sent up the bend of light. When he finally struck a match and actually applied it, the effect was much less pronounced than that produced by anticipation of a burn. In fact, the head moved so little that some one suggested a red-hot poker, whereupon the bead completely disappeared as I thought of the electrician's hands.

I was then told to recom-

pose myself. As the bead returned, a pungent odor, not infrequently encountered in laboratories, had the effect of sending it up the scale again.

Dr. Waller next warned me that he was going behind to do something to me of which I had no conception. Knowing what had already been done and what hadn't, and thinking of red-hot pokers and of the electrician's scarred hands, the spot of light traveled up that scale



How the emotions write their own autograph, according to Dr Waller's method. These records were made in order to show the similarity of movement when hand and foot electrodes are used

in a way that made me blush for shame when I felt my ear tickled after half a minute's suspense.

The last of the experiments practised upon me consisted in first composing myself until the bead was steady it zero. I was told to think of something (other than red-hot pokers) which had been a cause of worry and anxiety. That was easy enough—the only difficulty was to keep back a crowd of thoughts. I began to wonder what the editor would think of my adventure, and the bead of light traveled out of sight and remained there until Dr. Waller broke the spell.

So, an unpleasant taste, a feeling of nausea—indeed, almost anything that temporarily disturbs equanimity—is recorded.

As a result of a great number of experiments, Dr Waller concludes that, as a general rule, subject to some exceptions, anticipation produces a more powerful effect upon naval and military officers and members of the literary, artistic, and scientific professions, and that it is principally manual workers who respond to actual experiences more than to anticipation, which accords with most preconceived ideas upon the subject,

An important point about the instrument is its calibration. When it is

> set to suit a certain person's temperament, the diagram of results obtained cannot be directly compared with those obtained from another person for whom the instrument is differently calibrated. In other words, although zero on the scale (where the bend of light is at rest) is always in the same position, that position does represent not same degree of equa-

nimity for each person who is tested.

A Curious Fact

A curious fact in connection with the experiments is that they can be satisfactorily made only with alectrodes or metal disks on the palms of the hands or the soles of the Thus the electrodes may be on either side of one palm, or one may be on the pulm of one hand and the other on the palm of the other hand. The current from the Lechanche cells serves to equilibrate or balance the galvanometer reflector. The small electric cell sends a current of about one tenth of a volt through the circuit and the disturbance of the galvanometer by this additional curcent (which varies according to the resistance of the subject) causes the gulvanometer reflector to move and the

bend of reflected light to travel up and down the scale.

One of the strangest features in that the extent of the subject's emotions is recorded whether he be conscious of any emotion and whether he show any external sign of it or not. Indeed, pent-up emotion effectively concealed and controlled is indicated in a more pronounced manner than if relieved by weeping; and thus applies equally to other controlled emotions. Presumably swearing will now be conendered justifiable.

One may hope that Dr Waller will succeed in developing his invention so that different emotions, such as anger, sorrow, and fright, may be distinctly recorded



Here Professor Waller is measuring the energy which is expended in riding a bicycle

Cameras and Divers to Restore French Coal-Mines

BEFORE they retreated from the Lena district in France, the Germana flooded the coal-mines. Because France was thus deprived of one of her most important coal-beds, it was provided in the Peace Treaty that an adequate amount of coal must be turned over by the Germans to France. In the meantime, every effort is being bent to restore the mines to their former condition. To pump out the water will be a labor of months. Moreover, to facilitate it, the engineers must know exactly where the shalts and galleries were punctured

Accordingly, the French government decided to use un under-water camers for taking photographs of the shaft lining. The apparatus was supplied by the submarine

engineers, Stebe, Gorman and Company

Photographing under water involves the use of powerful lights. But even the most powerful lights in the turbid water of a deep shaft reveals little; its beams have but little penetrating power even under the most favorable conditions.

Artificial Sunlight for Under-Water Photography

White sunlight is a copmention of many end red rays hat those that are of greatest value in philography we cannot see at all. They are located at what a new as the ultra-violet end of the spectrum; they are the chemical rays that cause sunburn. These powerful unit would rays will not pass through ordinary given but they will penetrate a glass made of pure quarter lience, the light by means of which photographs are made to the shafts of Lens radiate a light that is rich in ultra-violet rays Instead of glass, quarter is used, which encloses a mercury-vapor are. The light of the mercury-vapor are is fain are to many who work in factories and, histographic gallenes, it was invented and introduced to Peter Course Rewitt Its color is a ghastly green due to a back of re-

This lamp, then, supplied a th quartz was a t of glass, is used in the camera to photograph the inundated walls

of the Lens mines.

The camera itself consists of three main gun-metal castings bolted together one above another. The upper and lower castings are each formed with four water-tight chambers, and each of these chambers contains a mercury-vapor lamp of three thousand candlepower. The cameras are in four chambers in the middle casting, which also carries four additional lamps, making a light-totality of thirty-six thousand candlepower. The shutters of the cameras are electrically controlled. Special haves,

actuated by rods, are provided to tilt the cameras.

Repairs can be made by a diver siter photographs have been made. After the holes have been stopped up, it is an easy matter to pump out the water

Here is the apparatus that is lowered into the flooded mines of Lena, France, to make photographs of their present condition



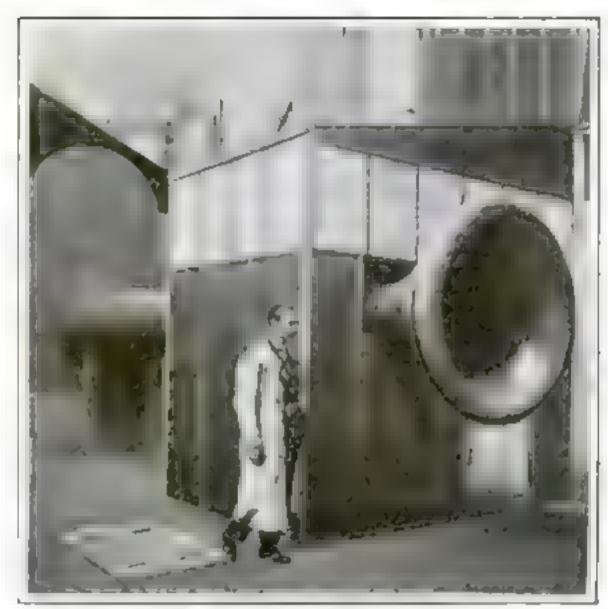
& Modern authorities intopolic drawing by G. H. to be

How the under-water camera and its lamps are lowered into position to photograph the shaft linings of the Lens coal-mines so as to locate breaches made by the Germana in order to flood the runes

Perfect Airplanes Are the Result of Wind-Tunnel Tests

THE airplane model is placed in a chamber in a long tube through which air is drawn in parallel currents. Instead of moving the models in the air, the air itself is in motion, which amounts to the same thing, as it is the relative motion that sustains a body heavier than air in

Attached to the model is a delicate scale called an "aerodynamic balance"; it measures the wind forces to which the model is sublected. Then one model is compared with another until one is obtained that offers the least resistance to the wind. Lessen the wind-resistance of any moving body, and you cut down the amount of fuel required to drive it at a given speed. Only by such experimenting was the airplane developed to its present form from the early crude machines.



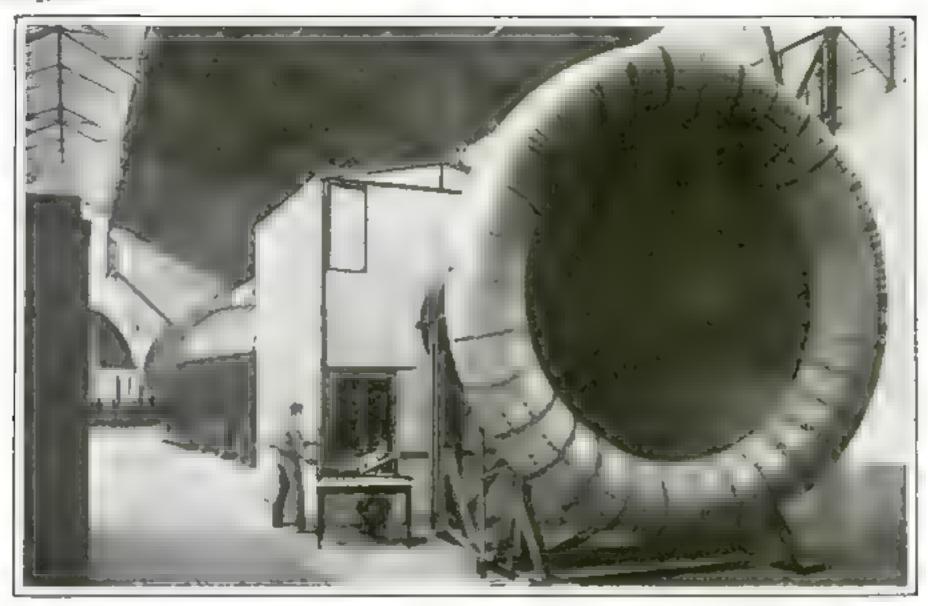
Here is one of the smaller wind tunnels at St. Cyr France. It shows the chamber in which both the model and the serodynamic balance are placed. It was with such smaller tunnels that the on the roots on an are aft

e will a ke to the of One of

design started. Nieuport was the first to attain greater speed merely by giving an amplane a form that offered the least resistance to the air and he was guided chiefly by the results of wind tunnel

After having been drawn into the turnel, the air is expensed through ar open cy indrical extension that differ it in a three stars The ray you be to alter an are to an upplier chocked at the first etc. y

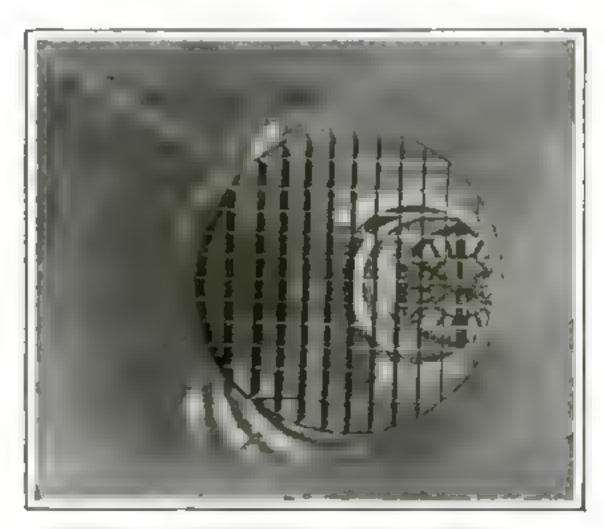




Outside the experimental chamber in which the acrodynamic balance and the model are placed sits a man at a table. His duty is to read the velocity of the air that is being drawn through the tunnel. When

a hundred-mile-an-hour gale is sucked through the tunnel, it is practically impossible to open the door of the instrument house in the center—so terrific is the suction





The air is composed of countless eddles and swirts. A straight stream is wanted. Hence a grid like that shown is used to break up the eddles—a kind of sieve, in other words. The speed of the wind can be varied from a sephyr to a hurricane. The model is suspended in the chamber above the aerodynamic balance and the air is drawn through the tube, Weights are added to the balance until the model becomes stable and steady. These weights measure the compensation of the forces of the air



Mid-Ocean to Become a Great White Way?

SOME of our transcontinental express trains carry powerful searchlights to entertain the passengers on the observation-car platform. The powerful beam plays over the interesting parts of the passing scenery. Great fan-shaped beams of light flickering over the Panama Pacific Exposition grounds amused the crowds.

Now it is proposed that the floating palaces of the sea

adopt the idea. It would indeed be an assuring speciacle to see a great ship blazen herself on a stul night of the sea, reckets breaking and shedding their scarlet rain on the dark waters.

Searchlights have reached a high point of efficiency, and the current to supply twelve large lights would be taken from the power plant of the ship without overtaking it

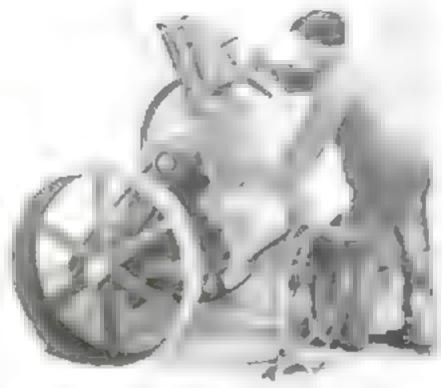
An Electric Sawmill on Wheels

WHEREVER electric power is available, be it in a shop or on a farm, the transportable electrically driven circular naw shown here will

prove very valuable. A small electric motor, which may be attached to any plug, furnishes power for the circular saw, which is large enough to cut four-inch planks.

The miniature sawmill rests on two large wheels and two supporting braces, and may be rolled to any spot where it is needed, even over rough pavement or sandy soil. It has been used successfully and economically in Germany, in spite of the fact that the cost of electric power in that country is considerably higher than in the United States.

In view of the fact that electric power is rapidly supplanting steam power or the power obtained from gasoline engines in this country, and that in most localities farms can be supplied at comparatively small cost with electricity, this sawmill should be of interest to the American farmer



This miniature sawmill on wheels can be colled to any spot where needed, it is run by electricity

Stronger Propellers for the Airplane

A PILOT landing a DN4 airplane at high speed encountered muddy ground. The wheels sank into the mud.

and the machine nosed over, the propeller making a number of turns in the mud.

If this vital part of the airplane had been made of wood, it would have aplintered into match-sticks. But it was made of "micarta," laminations of cloth or paper coated in "bakelite" and subjected to heat and pressure, What is bakelite?

Bakelite is a composition derived from the combustion of carbolic acid, creosol or phenol, and formaldehyde. Combined, these form a resin that, when subjected to combined heat and pressure for a suitable time, carries the material into a hard state not affected by ordinary solvents or temperatures that would disintegrate a gum or resin. February, 1921

Making Masks Is the Hobby of Wladyslaw Benda

By P. Schwarzbach



Mr. Benda wearing one of his bideous masks and carrying the lifelike heads of two girls. He makes these masks in his lessure moments and hungs them on his studio walls

Pick up almost any fiction magazine today and you will see the name "Benda" in the corner of many of the illustrations. Mr. Wladyslaw T. Benda comes from Poland and he gives to the men and women of his pictures the high cheekbones, the sianting eyes, and the delicate china peculiar to the people of Slavic origin. Yet he also puts plenty of American features in them.

When you enter Mr. Benda's gorgeous studio in the Gramercy Park section of New York, you are reminded of the "Arabian Nights." The walls are decorated with draperies and pictures of glorious barbaric color. And here and there you see a head so life the that, if Mr. Benda were not such a quiet, unassuming man, you would feel sure that he was a follower of Bluebeard. When you ark him about these almost human masks, he modestly tells you that he has made them himself!

What materials does he use? Wrap-

ping-paper, eardboard, paste, and paint. starts with strips of wrapping-paper and molds them bit by bit; he reenforces the weak spots with cardboard. Thus with neither forms por casts to aid him, he gradually builds up a face. When it is finished, he gives it several coats of paint until it is as smooth as skin and has the true skin color. He paints in the eyebrows and lips, and cuts out nostrils, eyes, and airholes in the forehead. As a matter of fact, he does not actually cut holes for the eyes. but rather punches them in. The rough edges thus made are painted black



Working with wrapping paper and cardboard, Mr Benda gradually builds up wonderfully isfeiske masks. He gives them several costs of paint until they are as smooth as skin.

and serve remarkably well as eyelashes. The inside of the mask is just a mass of short ends and glue; but when the mask is finished, this gets a coat of paint as well.

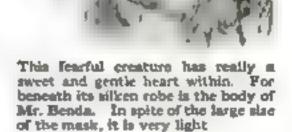
We are all familiar with masks. On Thunksgiving Day nearly every small boy in the country dresses up in his mother's or aster's clothing and buys

O Keystone View Company





"What a sweet girl!" you exclaim, looking at the picture to the left, then suddenly you notice the trousers and bug feet that show below the edge of the kimono. They belong to Mr Benda. He is shown working on a mask in the picture to the right



a mask that completely transforms him into another person. In drama and in dancing, masks such as those that Mr. Benda makes are a great help to the actors when they wish to portray various characters.

Even in the days of ancient Greece and Rome, actors wore masks. In England, just after Shakespeare's time, a form of drama known as the "masque" became very popular. And now we find it coming into existence in this country. Several of Mr. Benda's masks have been worn by Margaret Severa, a well-known New York dancer.

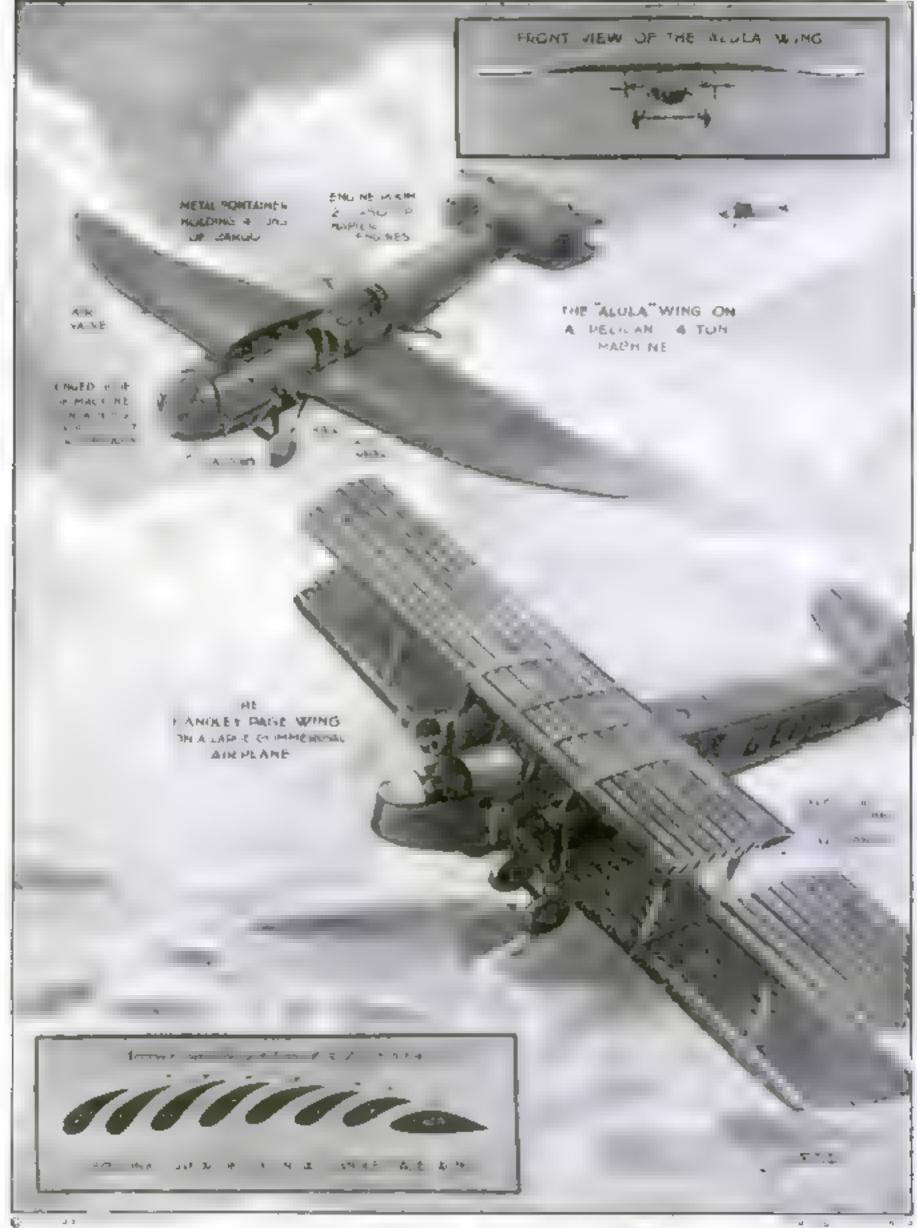
Some of his masks represent shy, demure maidens. He is shown below wearing one of this type, and, as you see, it completely transforms him.

He put on the mask of a terrible deep-see god, and looked so fierce that the spectators instinctively glanced toward the door. Mr. Benda has made several other strange masks, vividly painted in striking colors. Some of his women's faces are

haughty as well as shy. Some wear simple caps and others huge golden headdresses. One in particular has two long 'wrapping-paper') feathers of gold that ourl gracefully and sway slightly when the mask is moved. There is also a perfect head of a Japanese girl and the head of an angry man.

Mr. Benda spends much of his; source at this strange form of sculpture; and he has two able assistants.

One is a large black cat with the largest tail in the world, and the other is the smallest black kitten that ever climbed up the back of an upholstered chair.



Two New Types of Airplane Wing

In the new Handley Page wing abown in the lower part of the picture is a series of bollow curved vanes that convert a single large wing into a number of small ones. By thus exposing a larger area to the air, the lifting power is enormously increased.

In the Alula wing 'shown at the top of the page's an important consideration is the eliminating of the "end losses due to the curvature of the ordinary wing tip. This is overcome by apparatus contained in the Alula wing and operated by the navigator

Wings that Lift Heavier Loads

English designers are making renewed and effective efforts to rival the birds in the air

By P. J. Risdon

English correspondent of the Popular Science Monthly

ONE of the many difficulties encountered by aviators is to land in a reasonably short distance at a reasonable speed, especially in the case of forced landings. Another is to rise in a short distance. It is obvious that in the case of large machines carrying heavy loads this difficulty is enhanced, for the simple reason that the heavier the machine the greater the power and speed requisite to maintain it in the air. By means of the Handley-Page new wing, the distance run in getting off and in landing is reduced by twenty-five per cent.

This new wing of Handley-Page must be regarded as one of the most remarkable and important improvements in airplane design that has been made in years. In an elementary form it has already been tried on a de Haviland plans (D.H. 9) with a 230-horsepower Siddeley engine with

remarkable results.

Greater Wing-Lift Atlained

What is most noteworthy is the enormously increased lift of the new wing. Even the experimental airplane developed fifty-five per cent greater lift than another of exactly the same type without the special wing attachment, which was tested at the same time under precisely similar conditions. This result was secured by a single additional vans fitted in front of the ordinary leading edge of each wing. With wings conatructed entirely to the new design, it is estimated that the lifting power will be increased to such an extent that for a given horsepower of engine the same weight will be lifted by a wing area of not much more than half the usual ares. Alternatively the same wing area will lift nearly twice the load for the expenditure of the same horsepower, or the same load with a great reduction of horsepower

The design of the wing itself consists of a series of hollow curved vance or narrow wings which overlap but do not touch each other. At first night it would appear that by thus allowing air to flow through the vance the lifting power would be reduced, but that is not so. The spaces between the vances virtually convert a single large wing into a number of small ones, so that there is a far greater total area exposed to the air than in a single wing, thus increasing the lifting power

In future machines there will be five movable vanes arranged so as to open and close on each other somewhat in the manner of Venetian blinds or hinged louvers. The movement will, of course, be under the control of the navigator, who will control the extent of lift according to whether he is "getting off," flying, or landing. For instance, when he desires to attain full speed, he will close the vanes and practically convert them into a single wing. When he desires to reduce speed and to land, he will open them.

Owing to their small size as compared, load for load lifted, with ordinary wings, the new wings can be built much more stoutly, thus bringing the day of really efficient all-metal wings

within sight.

In the experimental machine, the additional small wings were fitted in front of the ordinary wings. The vanes extended from tip to tip of the wings, and were attached a few inches in front of the leading edge of each main plane by short bars. Even with this comparatively crude attachment, the navigator was able to fig at a speed of fifteen miles an hour less than the minimum speed without it; and although the tail was well down and the nose up and "stalling" appeared limitent, actually no such thing occurred.

Apart from this practical demonstration, extensive laboratory experiments and tests have proved beyond question that the principle involved is a sound one on which to proceed.

The Alula Wins

The Blackburn Company of England have evolved an entirely different type of wing, which dispenses with movable flaps, known as "ailerous," by means of which "banking" is effected. Here again greater lift for a given power was the main object, although there are other special features about both the wing and the airplane to which it is being applied.

In ordinary planes there is a considerable loss of power and lift, due to the curvature of the wing-tips. In the Alula wing these "end losses," as they are termed, are eliminated. As the picture on the opposite page indicates, in plan the wing has a curved leading edge and a straight trailing edge. Viewed edgewise, the trailing edge is horizontally straight, while the leading edge is straight in the center portion, then it curves downward, and finally

curves slightly upward. Between the leading and trailing edges the plane winds or curves in a manner determined by experiment.

In the curved portions of the leading edge are a pair of hinged flaps under the control of the navigator. The effect of opening one of these flaps, or valves, is to "spill" the sir, in much the same way that a jet of water directed into a jar is flung out again.

What the Flaps Accomplish

The opening of one flap increases the resurtance of the wing to which it is fitted, and the disturbed air whirling past the plane reduces its lift, allowing it to sink, and causing a corresponding lift of the other wing, so that the airplane automatically banks. Thus turning and banking can both be accomplished without the use of ailerons or rudder, although it is not proposed to dispense with rudders.

It was found necessary to raise the wings to a higher level, so that the planes are directly above the body of the machine. It is considered that the wing gives the best results on a monoplane, and it will be applied more particularly to air "tramps." Owing to the increased lift obtained, slower speeds are possible with heavy loads, and the design of the wing makes moderate speeds more economical

The Blackburn Company is accordingly proceeding with the construction of what they have named their fourton Pelican serial lorry, a machine capable of carrying a load of nine thousand pounds. The weight of the tramp itself, with fuel, will be fifteen thousand pounds. The span of wings will be 146 feet and the body will be 34 feet long and 14 feet diameter over fuselage. The two engines will be of 900 total horsepower, the cruising speed 72 miles an hour, the landing speed 55 miles an hour, and the rate of climb 410 feet a minute.

Radical departures are made from orthodox design. The pilot's cabin is situated in the nose of the fuselage. Behind it is the cargo space (seventeen hundred cubic feet) and behind that the engine-room. The pilot's cabin will be hinged so as to swing right open, and the cargo—which will be scientifically packed in containers and carried upon trolleys on rails—will be run out bodily. It is estimated that the cost of freight between London and Paris will be only five cents a pound. If that figure is correct, there should be a wide expansion of such traffic



Photograph by Charles Carrie for the Popular Science Mouthly

"The inventor can't do it all," says Edison; "you've got to change people"

Said M., Edison, in an interview with James H. Collans for the Popular Science Monthly:

"Greater and greater production is the real road to general prosperity. The country that can lead in this matter will tapply the world.

supply the world.
"This should be the job of the United States."

"The English, while fertile in invention, are extremely conservative. The Germans are more open-minded, but not

particularly inventive—they are most successful in applying the inventions of other people. The French are inventive, but their industrial genius does not run to quantity production.

"We have gone furthest along these lines, but our conservation is also great. However, spucred on by the necessity for replacing expensive labor with automatic machinery, manufacturers will be increasing output, employment, skill, wages, and standards of life.

Edison on Super-Labor-Saving Machines

Employers and employees are equally concerned in this question about which Mr. Edison has some decided ideas

PON every factory payroll there are two competitors in keen myalry to see who can work the cheaper

One is Wages, and the other Interest. Interest has certain advantages over Wages. An automobile factory, say, requires three hundred fenders a day. Hand production of one per hour per man, with a ten-hour day, would require thirty sheet-metal workers At five dollars a day per man, the labor cost would be \$150 daily, or \$45,000 a year. By investing \$50,000 in a special forging press, turning out the same number of fenders, two or three operators could be employed at ten dollars a day each, and the yearly labor cost cut to \$20,000, allowing for depreciation, wages, power, and so forth. Already there are such great presses in automobile plants.

Dollars can usually work cheaper than men, yet Wages has a curious advantage over Interest. For if the employees of the United States Steel Corporation put one tenth of their wages into the common stock of that company, within eight years they would own a controlling interest. Following the same plan, the railway workers could acquire a majority of the common stock in the railroads in twelve or fifteen years.

What High Wages Cost

Wages have been at record-breaking heights. There was talk of the tendollar-a-day workman. Not a few authorities believe that wages will stay approximately at these high levels.

If everybody can be employed at war wages, and production costs still be kept moderate, the result will be increased purchasing power and comfort. But if higher wages continue without increased production, then purchasing power must be limited, for producer and consumer will umply be playing the game with counters having higher values marked upon them, but purchasing no more commodities. Idleness in a war-cost world is tragic to the ten-dollar-a-day workman, with food, rent, clothing, and all other necessities at abnormal levels. Many thousands of workers this winter can testify that idleness at ten dollars a day is different from sileness at three dollars.

High wages stimulate heavier investments in labor-saving machinery. Such machinery increases production, lowers costs, broadens purchasing power, and eventually increases the wages of employees, who, while fewer in number, must have greater skill. Wages and By James H. Collins

living standards are highest in countries with the largest investment in machinery, like the United States, and lowest in countries where machinery has not yet replaced human muscle

Do present conditions point to a new are of invention? Will it pay to invent and install very complicated and expensive machines—devices costing a quarter million, a half million, and even a million dollars, and doing the work of hundreds, perhaps thousands, of men and women?

Meeting the "Wizard"

With these thoughts in mind, the writer went over into New Jersey to see an inventor whose work in the part forty years has probably done more to increase jobs, wages, the output of commodities, wealth, and comfort generally, than that of any other individual. Out of Edmon's brain have come not only complete industries like electric lighting and power, but enormous expansion in human production, and enormously increased consumption of things as diversified as copper, coal, piatinum, trolley transportation, building materials, real-estate values, wire communication, music, the art of the actor, and business correspondence.

At Eduson's library, they were dubious about an interview. The "Old Man" had been working at a terrific pace lately, and was "jumpy." Somebody had seen him disappear in the direction of the laboratory around noon. It might be necessary to walt an hour, maybe longer. And a highly condensed interview was urged.

Within five minutes the "Old Man" turned up on his way to the library for data. His face looked drawn and his eyes tired. His clothes needed brushing and pressing; his old derby hat was dusty. While explanations were being made he had an absorbed far-away look; but at the bare suggestion of the idea his face lighted.

"I've been working at that for fifty years," he said. "But the trouble is, you can't get people to do it! We have in this country an enormous capacity to invent super-machinery. But our desire to install the device is very, very weak. Human inertia is the problem, not invention. Something in man makes him resist change. He chings to his old equipment, and processes, and habits, rather than acrap them for something ten times more productive.

"Now, that probably sounds as

if I meant the wage-carners who feel that new inventions will take their jobs away. But I mean the manufacturer too. It is just as hard to change him "

As an illustration, he went back to his automatic telegraph, which in the seventies scared British post-office officials with its prospect of one thouand words a minute

"In London I met an operator who asked me if I knew his brother in New York. We had worked together. 'I'd like to have a word with you, but not here,' he sald. We went out to a beer

saloon.

"They've put up a job on you," he told me. "They don't want your system to succeed, and are going to give you the old Bridgewater Canal line to Liverpool, which is never used now. If it has one leak it has fifty—I don't think you can get a message over it at all."

"Well, the only answer to that was to use a very strong current. Remember, there were no dynamos then-electricity was still in the battery stage. At Appe' in the Strand—famous instrument-maker, you know—I found a big battery that Tyndall had used in his Royal Institution work. It cost a sovereign a cell and we needed one hundred cells. Five hundred dollars was a lot of money then, but my backer was game. We put that battery on the Bridgewater line.

The Unpaid Bill

"We sent one thousand words a minute without a hitch-perforated paper—came out beautifully, without an error, clean and black—no, blue. The trial was repeated—perfect transmission. That battery jumped all the leaks and stood up for half a dozen tests, and had plenty of power left at the finish."

Edison chuckled over this defeat of red tape nearly half a century ago.

"They adopted it eventually," he added. "but from that day to this we have never received a penny from the British government—not a cent!"

Eduon maintains that we haven't begun to utilize our opportunities.

"We had few automatic machines in the seventies and no very big ones," he continued. "But there was one invention that embodied the whole principle of large-scale automatic production -the Jacquard loom. It has been turning out beautiful fabric patterns for more than a century. In purely automatic mechanism a supreme achievement, tramendously

complex, yet absolutely practical. Once a pattern is set on its cards, the Jacquard loom will turn out that pattern over and over again, as long as you supply material, power, and upkeep, to the end of time. But applications of the Jacquard perforated card principle to production in other industries are so innited that you could probably count them on your fingers. Other basic principles are cams on shafts, the pantograph as applied to the eccentric lathe, the drop press, rotary press, special drill jig, the grinding method of removing metal, and so on. All the inventor need know is what you want to do, and how much of it you have to be done, and he can furnish automatic processes and bigscale mechanism. Sometimes the problem will be worked out on mechanical

lines, again electrical, again chemical. New principles will be found, of course, but those already available would keep the inventor and designer busy making new applications if invention were the whole problem. But it isn't. Human inertia in the problem—you can't get people to see the point!

A Government School

"More machinery, bigger, more complex, more automatic—why, that is so important that I think the laited States government ought to found an institution— The "Government School of Automatic Machine Designing" The best brains available should be put to work. And there ought to be a fool-proof system of questionnaires for weeding out the unimaginative.

"What line will invention take?" was asked. "Will the new machinery be big, complex, rostly? If we have factories installing million-dollar machines, won't that make the billion-dollar corporation obsolete?"

"It depends on the industry. When automobiles are turned out by the thousand, special machinery is possible. Cost of equipment is not important if you have volume of output, because interest is cheaper than wages. Suppose an automatic machine costing \$1,000,000 displaces 1000 mechanics. At \$50-a-week wages per man, that saves \$2,500,000 on the payroll. At 6 per cent, your militon-dollar machine costs only \$60,000 a year for interest, and \$200,000 depreciation on a life of five years. Lump interest, depreciation, upkeep, and operation together at \$500,000 a year, and you have saved the cost of the machine the first six months. When you remember that such a machine may also double or

treble production, it might be economy to replace even one hundred mechanics with a million-dollar mathine."

"Will present high wages hasten investment and invention along this line?"

"I hope so, but I am also skeptical. Wages are certainly high enough to-day, and skilled workers far from plentiful. That may play its part in appealing to the imagination of the manufacturer. But it also increases the opposition of the worker, who naturally fights harder to keep a hundred-dollar-a-week job than one at twenty-five dollars a week. Automatic machinery is just as profitable and descrable when normal wages prevail. Why, automatic machinery in most industries would do away with ninety workers in every hundred. That

"You Can't Get Men to See the Point," says Edison

"IT'S easy to invent, but hard to change men," says Edison. "Human inertia is the problem to-day—you can't get men to see the point,"

"Will present high wages hasten investment and invention?" asked Mr. Collins.

"I hope so, but I am skeptical. Automatic machinery in most industries would do away with ninety workers in every hundred. To prepare themselves for such changes in industry, workers should acquire an open mind and broad viewpoint toward the modernization of industry. Instead of acquiring a trade, the worker should be ready to see this work change again and again in a lifetime."



This is James H Collins, who interviewed Mr. Edison for Popular Science Mouthly

rounds cruel, doesn't it? Labor fights the suggestion everywhere. But automatic machinery will benefit labor, both in earning power and commodities. If machinery supplants nine men out of every ten in a given industry, what happens first? Each man kept on the payroll can earn higher wages, because more skill is required to operate the more complex and costly machinery. Then production increases,

goods are cheapened, more of them sold, and more workers employed. Show me a work-force of 10,000 men, and 1'll show you 4000 or 5000 who ought to be retired. In 10,000 families there are probably 5000 persons who should not be working, but enjoying life instead. They can't do it now. Automatic machinery will let them do it."

"What can workers do to prepare for such changes in industry?"

"Many things. They might acquire technical knowledge and he ready to qualify for the better jobs made possible by the automatic machinery. Even more to the point would be acquiring an open mind and broad viewpoint. Instead of a job and a trade, something learned once and made to last a lifetime, the worker should be prepared to see his work change again

and again in a lifetime. But it is hardly fair to expect that of employees when so many employers fail

"It is a job for the salesman as much as the inventor. Markets must be expanded so that they will take commodities in unheard-of quantities, and juntify big-scale production.

Every increase in production, every new invention, like the automobile, increases jobs and purchasing power. Greater and greater production, with abundant commodities for everybody, is the real road to general prosperity and a higher standard of life.

America's Job

"The country that can lead in this matter will have the job of supplying the world. It should be our job. The Frederick are

our job. The English are extremely concervative, and while they learned to talk of quantity production during the war, there has not really been any great change, although they are fertile in invention and research. The Germans are more open-minded, but not particularly inventive—they are most euccessful in applying the inventions of other people. The French are inventive, but their industrial genius does not run to quantity production We have gone farthest along these lines, but our conservatism in also great. If high wages continue, and force us to think harder, and improve our methods and increase output by new, large-scale devices and processes, that will be a good thing. Spurred on by the necessity for replacing expensive labor with automatic machinery, manufacturers will be increasing the output of commodities, increasing employment, skill, wages, purchasing power and general standards of life."

A Paper Suit for One Dollar

Making a virtue of one of the war's necessities

EOPLE are wearing paper clothing and even paper boots, in Argentina, Austria, Germany. Great Britain, Italy, and Turkey. The style originated in Austria and Germany, where one can buy a workman's suit for 58 cents or a regular suit, machine-tailored, at from 29 cents to \$2.50, an overcoat for 51 cents, a pair of boots for a quarter, and m hat for a dime.

Germany had to avoid audity when she was cut off from overseas supplies of cotton, wool, and hemp. The only available raw materials were paper and cellulose fiber. So there was nothing for it but to wear paper.

As a matter of fact, not only are clothes made from paper, but several hundred other commodities of daily use. Apartments can almost be furnished with the paper goods appearing in foreign markets now: towels, quiltings, upholstery goods, bed- and tablelinens, curtains, sewing-threads, cacks, overalls, raincoats, collars, embroidered blouses, hairpins, hangings for walls, imitations of Persian carpets, and even horses' harness and piping for all and gas.

All of these materials are made from so-called paper yarn—in reality cellulose, which makes up the framework or structure of all vegetation.

In making paper yarn, the cellulose is transformed into paper, or old paper is used. The manufactured paper rolls often weigh as much an eight hundred pounds. They are cut into narrow strips from one eighth inch to six inches wide. These strips are tightly wound into disks.

Twisting of the strips into round threads is next in order. The German method is this: The disk is contained in a flat holder and the stripped paper is twisted by two small rolls above the disk. Then the twisted yarn is wound on spools. Sometimes the paper yarn is moistened to make it plusble for twisting, and chemicals are added to give the finished product flexibility. pliability, and durability.

The greatest care is exercised in controlling this twisting process. If there is too much tension, the yarn tears; if there is too little, the product is irregular. Therefore the twist gearing is continually readjusted to give the right amount of twist.

After twisting, other fibrous materi-2ls are woven in. Wastes from cotton and flax are introduced in paper thread. To increase its resistance and to waterproof it, the yarn is automatically passed through a warm bath of mixed glue, tannin, and water glass. Then it goes through a cold bath of

By Dr. I. Newton Kugelmass

aluminum formate and is dried immediately. This treatment does for paper yarn what tanning does for the skins

Paper clothes can be washed with hot but not with boiling water. They cannot stand machine laundering but must be hand cleaned or brushed. Acids ruin them; alkalis agree with They cannot go through a wringing process but must be allowed to dry out. They cannot be mangled. They will stand pressing, but it is safer

not to iron the borders and folds. On the average, a piece of paper goods or a suit can be washed twenty times.

One hundred million pounds of paper fabric is being manufactured annually in Germany. England is making paper yarn with American machinery. France makes a paper for clothing as well, but it is backed with cloth. Japan is using paper for straw hats, for filling silk, and for making thread. Most Japanese paper yarn is made from bamboo paper. Finally, Sweden and Denmark are just starting in the paper goods business.



Linoleum (sq. yd.) 33



To regulate the flow of the water, this tubular weir is raised or lowered by a movable member operated on abore

This Big Pipe Regulates the Flow

WEIRS are placed in rivers, canals, and other natural or artificial water-courses to regulate the waterlevel in accordance with requirements. Emergencies like floods, freshets, and ice blockades call for an immediate change of water-level. In such cases most of the known types of weirs fail because they are too complicated to operate.

A striking exception is presented by the tubular weir, a recent invention that has proved its merit under severe tests. That shown in the illustration is not the largest.

The movable member of the weir is a tube of riveted steel or from plates.

Its length depends on the width of the river or canal, and its diameter on the height to which the waterlevel is to be raised. This watertight tube may be raised or lowered by a chain which engages sprockets in a band that encircles the tube at one end. The tube is rolled up or down an inclined bed in the masonry of the land support of the werr. either by hand or by motor Both ends of the tube have gears that engage racks on both sides of the weir



This iron reven is two hundred years old, and conses from Japan

An Old Iron Raven that Comes from Japan

"HIS is not the famous raven I that perched itself on Edgar Allan Poe's door and quoth "Nevermore." It is a less famous raven that is perched on the floor of a glass case in the Metropolitan Museum of Art, New York city, and says nothing. There is a very good reason, the raven is of iron.

It is more than two hundred years old, and has traveled all the way to New York from its native country, Japan. A Japanese artist in fron, Myochin Shikibu Kino Munesuke, designed and made the raven, and then signed his name in Chinese characters under the

raven's tail.

Muneauke was a descendant of a well known artist armorer who lived in twelfth century, and he himself made many pieces of armor.

Japanese artusts who work in iron use no pollahing processes at all to improve the finish of their work; yet they will often cut their lines to a uniform depth and fill them with gold and BIVET

How Paris Is Making War on the Rat

URING the world war, which disorganized all branches of pubhe service in the belligerent countries, ft became impossible, among numerous other things, to continue the warfare against the rate theretofore mercileasly conducted in all civilized countries of Europe. As is well known, the rat is

extremely destructive and is known to be the carrier of dangerous parasites and of even more dangerous disease germs. In consequence, its enormous increase became a public menace. requiring immediate attention

In France the situntion became critical when sporadic cases of a disease. strongly suspected as being the buhome plague, were discovered in Paris and

some of the large seaport cities. The authorities recognized the absolute necessity of energetic measures, particularly in the large centers of population, for the complete extermination of the rat.

The municipal council of Paris, urged and vigorously supported by the

Emptying a bagful of rats, preparatory to carrying them to the



A twenty-five-centime bounty has sent Paris buskies into the sewers to hunt for rate

health authorities, met, and after a thorough discussion of the problem declared war against the nuxious rodents. An appeal to the public was issued which asked all citizens to assist in the war of extermination by providing covers for all garbage receptacles and by catching and destroying as

many rate as possible.

As an incentive to more vigorous effort in the destruction of rats, the city authorities offered a premium of twenty-five centimes for each rat killed and delivered to the proper district officials. The dead animals collected at the different district stations are sent to a central station, where they are cremated. Rat-killing is now a popular sport in Paris.

Would You Sing?

Then you must first learn to breathe properly

An inventive singing teacher has finally given to the world a mechanism that will perform the most trying labor of singing lessons. Not only singers but public speakers will be benefitted by this new invention, while the number of cases of pacumonia, influenza, consumption, and other diseases brought about by incorrect breathing will be reduced to a minimum.

The inventor is Professor Bertrand de Bernys, a voice specialist of New York city, and the mechanism, which he recently patented, he calls the oxygen indicator. The apparatus indicates the lack of oxygen in one's system, increases by proper disphragmatic breathing the amount of that oxygen. strengthens and develops the lungs, increases the stock of vitality and mental energy, dislodges many of the germ pockets, and lessens the danger of germ development.

Professor de Bernyz realized that improper breathing interfered with the development of singers. He has devoted the best part of his life to the perfection of a machine that would point out and then remedy faults in

The machine in Itself is

breathing.

waistline and connecting with a dial. As one inhales deeply, the pressure of the abdomen against the band causes the dial hand to move across a series of figures. The figures indicated show just what amount of available space for oxygen one has in one's system.

When there is a lack of oxygen space indicated on the dial, the pupil knows that he must undergo certain caluthenics to develop the diaphragm. By consulting the oxygen indicator he may see what progress is being made toward the improvement of his breathing system.

"Every one should be capable of drawing in and maintaining two cubic inches of air for every pound he or she weighs," Dr. de Bernyz claims.

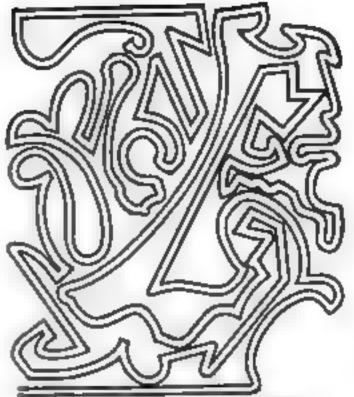
"People do not breathe deep down. They try to reach high notes or to hold notes when there is no air in the stomach. The human body is made up of organs for breathing purposes that are never utilized. Most people sing from the throat and not from the

diaphragm. If they would breathe properly, they would at least learn to use the physical apparatus that ... ture gave them "



In this picture Professor Bertrand de Bernyx is demonstrating his voice-culture apparatus. The center picture shows the instruments measuring how deep a breath the man is talong

Other parts of the apparatus. Professor de Bernya declares that few people breathe deeply enough that we should inhale two cubic inches of air to every pound of our weight, filling our stomachs as well as our lungs



Can you draw, rapidly, a continuous line between these parallel lines without touching them? If so, you are

A Psychological Test for Speed and Accuracy

TAKE a sharp pencil, place the point between the two parallel lines in the lower left-hand corner of the "maze" above, and draw, as rapidly as you can, a third line. This line must not touch other of the original lines, nor must you shift the position of the magazine or lift your pencil while you work. Keep a record of the time it takes you to complete s trip around this very complicated design.

Such is the Thorndike "maze test" used in many schools for determining the drawing speed and accuracy of the pupils. Speed and accuracy are the chief factors in efficiency, which is all-important in this twen-

tleth century.

The children are given seventyfive seconds in which to work. At the end of that time the number of linear inches they have covered are computed and errors recorded. Some children are quick and careless, and others work slowly but accurately. Both types are given the proper instructions.

The test is given again an hour later. After five consecutive tests have been made, the records are tabulated by considering the average results of the first test as one hundred per cent efficient. This is used as a basis for the other tests that follow.

Results show that speed of movement increases steadily during the day. Accuracy, however, varies. It improves gradually till lunch time. After lunch it declines. Is this not another indication of the fact that work done in the morning is apt to be more correct than afternoon work?

The lights that make possible a photograph of this drawt hole up scene at night get their power from the portable plant shown at the right. At the right you see part of the portable power plant is the cables carry the "j m. tell cables carry the "j m. a switch panel, whence at us dis-

Taking Electric Light into the Desert

"THE Hold-Up at Night in the Desert" flashes on the screen, and then you see your favorites lose all in a real, true desert. If you are not too much affected by the touching scene, you may wonder how the proper electrical affects are accomplished in that anot in obvious darkness.

Ly by ted no needed

One large moving-picture company takes light to the desert by means of the portable power plant shown above. Two electric cables lead from the power plant to a switch several feet away. Here many wires branch out, carrying lights of varying power at the ends. Thus the "movie set" can be located at considerable distance from the power plant.

A few spotlights are usually focused on the scene being taken, and several broadside lights are lined up on either side.

Making Use of the Smoke of Walnut-Shells

CHICAGO packers boast that they use every part of the pig but the squeal. California walnut-growers burn the nut-shells for the charcoal produced and they also make use of the smoke.

Thousands of tons of nut-shells are produced every day and their disposition became a knotty problem. During the war, the shells were ground up and used as a hardener for explosives. With the advent of peace, this demand ceased and large quantities of the nut-shells accumulated. It cost too much to cart them away to the dump. "Why not burn them to charcoal and sell the product to poultry-food dealers?" some one suggested. This was a thought,

The walnut-shells are first placed into a large bin from which they are fed into a rotating gasheated kiln, where they are burned to charcoal. The small black kernels produced sell for seventy dollars a ton.

The smoke and gases from the burning shells pass into a long iron flue where they come into contact with water spray. A heavy mist or steam is formed. A suction fan is placed at the end of the flue, which sends the steam and light gases up the stack, where they discharge into the atmosphere. The heavier particles, laden with crossote, denatured alcohol, acetic acid, and other compounds, precipitate into a receptacle at the base of the stack.

The process is continuous and it requires very little attention. Two or three men are able to handle many tons of walnut-shells a day. They not only earn their salary, but add a handsome yearly profit to the walnut-growers' incom.

A Wild Airplane Ride through Omaha

WHEN a wild-eyed bronchobuster dashed through the streets of a Western city in the early days, the inhabitants scurried to safety. Now comes a man dashing through Omaha in an airplane.

For more than an hour he rushed down between buildings, and as a diversion did nose dives and tail epins at points only a few feet above the trokey-wires. His thrilling ride ended in the police court.

Nebraska has no ordinance regulating serial traffic, so the aviator had to be tried under a law known as the "Runaway Team" law



In California, walnut-growers are getting charcoal from burned walnut shells; the small black kernels sell for seventy dollars a ton



Landmarks for the Aviator

STANDARD arrangement of landing fields would be an advantage to the itinerant airms who flies at night and who comes down in a strange region. For instance, if the pilot knows where the radio tower is placed with relation to the sirdrome, he would know at once how to avoid a possible crash in approaching the field in thick weather. Vertical and portable searchlights illuminating the field are indispensable.

Directing an airplane by wireless, the so-called "radio localizers" on the modern landing field should bear a

definite relation to the position of the nirdrome. A plan suggested by the United States Air Service furnishes an ideal arrangement of these details. On one side of the airdrome is placed the meteorological and radio equipment structures, which project upward and obstruct a clear approach to the field. On the other side of the airdrome are the localizers and the fog-dissipation mechanism built underground, and the markers. Here nothing projects into the air to hinder low flying when looking for the landing place.



Child Welfare in Japan

N Japanese schools the physical develop ment of a could is given as much atte to as his mental development. On warmdays he strips to the waist and his ten arwatches him closely as he works. If we breather improperly, he is corrected, if he given speria, exercises, if he is too thin for his hoight, a special diet is recommended

In Japan, as in the United States, every child must go to school when he is an yearoid. He receives a six years' course in piorals, reading, prithmetic gymnastic und poetry

A New Garment for Surgeons

THE ghostly garments that surgeons wear when they operate are usually buttoned from neck to wasst. The buttons are very ant to fall off at the wrong time and even at best they are annoying when a surgeon is in a hurry to get in

A new type of operating garment has been invented recently by Mrs. T. H. Hinmun, of Atlanta, Georgia. There are no buttons or hooks and eyes on it-two strips of tape that tie at the bank hold the entire garment in place. The two front halves of the waist have extensions that reach around to the back so shown in the Illustration. Why not make mechanical clothes this way?





Lift the Records with a Suction Cap

ACCIDENTS will happen to phonograph records, no matter how carefully one handles them. Oftentimes a record is badly injured while being removed from the machine. This happens through the hand slipping and one of the fingernails digging into the soft surface of the record. The next time the record is played. there will be a chok-click-dick as the needle passes over this point.

A little rubber cap, attached to the phonograph by a spring, enables one to remove a record with but slight danger of an accident. It is simply pressed to the surface of the record. It gripe tightly and lifts the record into the hand with an easy movement.

Wanted: A Substitute for Goldbeater's Skin

ARGE rigid alrehlps, such as the R-34, which crossed and recrossed the Atlantic ocean in 1919, contain nearly a score of gas-bags filled with hydrogen.

Each gasbag is lined with goldbeater's skin, taken from a certain part of the Intestines of a cow or ox. No other membrane answers so well in preventing gas leakage

The intestance of five hundred thousand cattle must be handled, scrubbed, cleaned, and applied to line the bags of so big a dirigible as the R-34. The cost is about \$200,000.

Here is a chance for a chemist to provide a cheaper substitute that is impermeable to hydrogen gas.

Canoeing in the Swimming-Pool

WE have indeer awimming and tennis in winter so why not indoor canoning? In most winter pools there is nothing to to but were You each't lay yourself out as will surely say on the wet payersent around the power he women don't even have the pleasure of laplaying their apti-

But if there are a few canoon in the paol, there will be plenty of aport. Cance hardbur, for instance, can be practised with entity safety. Even short races an actaged

The Chef's Daily Manicure

NE of the daily events in the life of a chef in any of the large New York hotels as his morning manicure. Before he touches food, his hands are carefully washed and his nails are cleaned, cut, and polished.

The job is not given to a sweet girl manicuriet, but to one of the hotel physicians. He is always on hand during the day; should the chef accidentally cut himself, the doctor will handage the wound, as he is there for that purpose

Chefs are precious these days; many of the French ones-unable to get their daily bottles of wine-have gone back to France, where the thought of problettlon can still be treated as a joke, though even in France there are heard ominous rumbies between the jokes passed at our expense

O Kermone View Company



Keeping the Tracks Clear of Tropical Grass

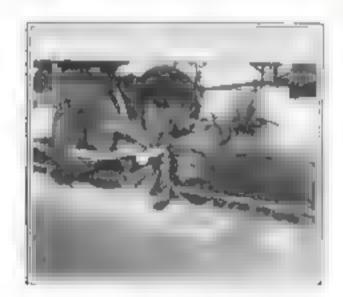
HERE is a rotating wire brush that can tear up the weeds and grass.

Remada gram is a tough tropical gram that grows along the railroads in Texas. It grows rapidly and it rosts much to remove it. One of the engineers on the road hit upon the happy idea of attaching a wire brush to a number of ears. It proved very effective.

Four brushes are mounted upon a heavy shaft. This shaft is driven from one of the car axies by a best. The pulley mounted on the car axie is large, so that the wire brushes reach a high speed even when the car is traveling at ordinary speed.

When the brushes are revolving at high speed, centrifugal force causes the strands of wire rope to stiffen

The steel wires are so rigid that they are just as effective as solid steel rods would be, and the weeds are hit with terrific force.





Carry Your Own Punch

NEW and mysterious is the glass bottle that is shaped like as hourglass but that contains something much more energetic than sand. The contents are in liquid form, and when dumped into a bowl containing sweetened water will form the concection known as orange punch!

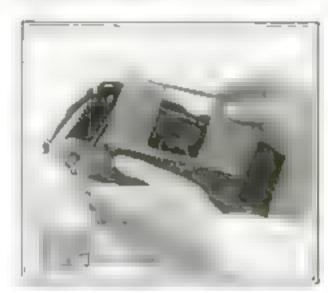
Each half of the glass bottle contains a separate liquid, and the two are kept apart by a cork placed between them. They do not come into contact with each other until they are dropped into the water simultaneously.

You might get one of those bottles and, if you are not partial to orange punch, fill the orange end of the glass with some other flavor

Two Sizes of Photographs with One Camera

IT is a simple device that enables the photographer to adapt his camera so that it will take two sizes of pictures. A stiff paper mask is fitted inside the camera, between the lens and the film, while a small mask of the same proportions and covering the same field is fitted over the finder

A cogged wheel having numbers near its rim is arranged on the outside of the camera's side, so that it engages the attachment of the film-turning device. These numbers are so spaced that they indicate exactly the section of film that occupies the position exposed to the lens. In this way a film \$14 inches wide, taking six pictures normally \$15 inches long, can now include thirteen pictures \$14 by \$14 inches. This is a convenience to be appreciated by one who likes to use his camera for large as well as small photographs. When he can take thirteen pictures instead of six, there is considerable economy to his advantage



This Ship Traveled to its Destination in Instalments

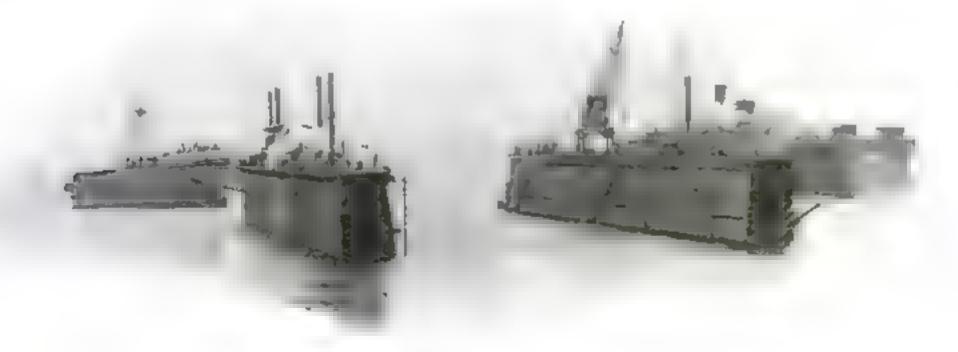
THE Canadian Ranner was constructed loland for use on the seas. After she was put together at Port Arthur, Canada, the engineers were confronted with the problem of floating her to the ocean, since the locks along the Lachine canal, which parallels the St. Lawrence river, could not accommodate such a large boat. The boat was cut in two, tightly boarded up, and towed to the Atlantic ocean, where she was reassembled and made ready for her first trip on the bring deep.

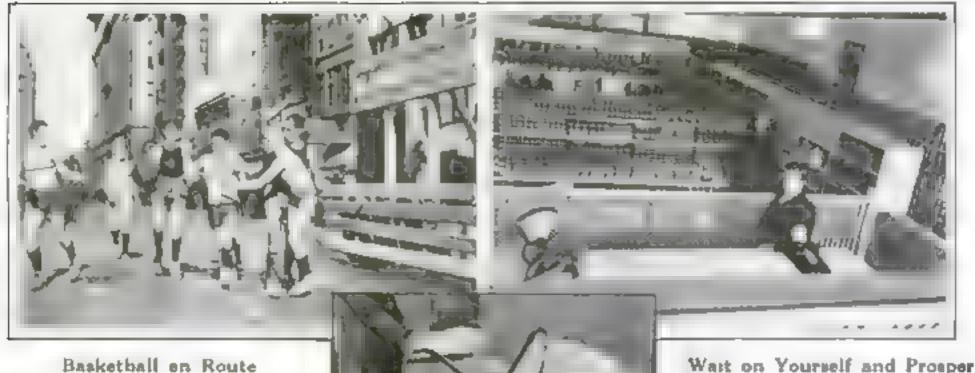
The reader will probably look upon this work with the thought that it involved a great outlay of money and labor. It really did necessitate considerable labor and expense, but not nearly so much as the average man would believe. The steel plates of the ship were merely unriveted in a floating drydock, and the ends of the two halves were carefully boarded up with two-inch planks. All of the cracks were filled up and water was allowed to enter the drydock. The two halves of the boat were then pulled

out by attending tugs. The tugs also pulled the divided vessel through the canal

At the opposite end of the canal another floating drydock was brought into use and the two parts of the vessel were placed in a When the water was pumped out of the dock, the planking that covered the ends was removed and the rivets placed. In a short time the vessel was ready for service.

During the war Canada cut several ships in two in order that they might pass through the Luchine canal locks.





Basketball on Route

WE'VE had so many parades in the past lew years that a parade must now he very unusual to attract attention Thus when the boys' clubs of San Francisco had a parade recently, they provided plenty of entertainment for the watchers.

Two picked teams played basketball throughout the entire line of march. Their goals were carried by two large motortrucks, which moved slowly at the sides of the street. Only the truck chassis was med in each case, and the baskets were mounted on wooden frames. The people on the sidewalks were well able to see the spirited sums. The idea was novel, but history says nothing of the disappointed ones who just missed seeing a goal won.

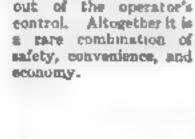
A Tilting Reel for Wire

IF you have wire to wind or nareal, this tilting reel will solve your problem. Every one who has had occasion to handle wire known how may it gets tangled up into a hopeless mess.

This reel is double-jointed throughout, and it can be placed in any position. When a heavy coll of wire is to be placed upon the real, the real is tilted over and Abor in an ved

The heavy counterweight at the lower end of the shaft up which the reel revolves bespe the workman to throw the real back into position. The pegs on the reel are adjustable for different sized colls.

Whatever position is desired, the reel is so perfectly balanced that it will never be



The Self-Loading Hand-Truck

VERY often the sametance of an extra man besides the operator is required to load a hand-truck. To avoid this, a truck has been invented that permits the loading of any reasonable weight by one man

The truck is placed upright close beside the article to be leaded. A long adjustable lever, which can be raised or lowered lengthened or shortened, by means of teeth on its lower edge, extends from the truck's only handle, and groups the article to be loaded by means of a hook on its further end. One foot is placed on the lower part of the truck, the handle is pulled forward, and the truck is loaded.

The Smallest Automobile

OMPARED with the tlay car in which Misse Ula Sharon, a New York actress, travels up and down Broadway, the "filvver" is a monuter. When she arrives at the theater she doesn't park her "roadster" outside. Not at all; she drives it right into her dressing-room.

It is so small that if Mus Sharon should get careless and gala a few pounds in weight she wouldn't fit it. The car gets its power from a storage battery and will go ten miles before it Boods recharging.

With such a tlny car she can work her way up to the front ranks when a policeman holds up traffic and thus best out the large, powerful automobiles.



OU want a loaf of bread, and you want it is a hurry. But when you enter the bakery, there are several people before you and you must wait impatiently 1. 3 ar turn arm as, or even longer, if the autocrat behind the counter happens not to like your looks. That loaf of broad you want is within your reach. If only you could pick it up and pay the cashier!

That is exactly what you can do in the new self-serving stores that are being intro-

duced all over the country.

The merchandise is displayed on a series of shelves between which there are connecting assist. You wask through the aules, gather in the goods you want, and then proceed to the cashler's deak.

It's Small but Husky

"HE implement shown below is a jitney in every sense of the word. It costs only five cents an hour to operate, and it will do many different jobs-plow snow, pull logs, and haul wagons around the yard of a factory. It will also saw wood run an electric generator to light a farmhouse, or pull a cultivator through a truck-garden. It is a gasoline jack-of-a.l-

It is controlled through the handles in much the same way that a motorcycle is controlled. It rolls along at a comfortable pace even when it is working hard.









Typewriting Helped by the Feet

TYPIST who prefers to use his foot A instead of his hand in drawing back the typewriter carriage at the end of a line can use the invention of Edward A. Pfefferle, of Burley, Idaho

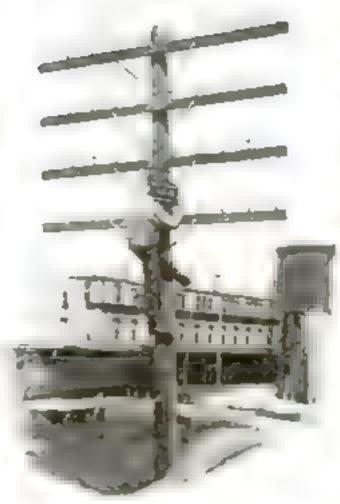
A telescopic rod on top of the desk connects with the typewriter carriage and operates without springs. The fact operates the device in both directions, pressing down with the ton when drawing the carriage toward the right and spacing lines, and pressing gradually downward with the heel as the writing proceeds to the end of a line. When pressure is placed upon the heel-end of the foot treadle, the rod telescopes and gradually extends so the typewriter carriage moves toward the left.

A Ship Designed for Stability

SINCE the great concrete ship Forth was constructed several years ago, a numher of experimental vessels have been produced. Here is one of the latest, made in Denmark

The good ship Bartels may be seaworthy and staunch, but she has very ugly lines, as a giance at the photograph will show Her design would please a cubiet, but an ordinary human being can see nothing benutiful about her

The engineers who designed the Bartels gave her this peculiar shape to make her stable while at sea. She is of recolorced concrete, which, her makers may, makes ber practically unsinkable. Whether or not their theory is correct is not known, since thu fond child of their brain has not as vet had a taste of the briny deep.



It Locates the Trouble with the Telephone Wires

EVERY city has its network of wires, and it keeps many linemen busy the year around to maintain the service.

Toll lines often have an earning power ranging from thurty to one hundred dollars. an hour, which means a big loss for every minute the line is unnecessarily out of order

lanemen with ordinary talking sets are unable to make specific locations of trouble and must be guided entirely by a test man at the wire chief's office. Furthermore, when a lineman calls in for tests, he ties up another circuit, making a loss appear on two circuits—the one he is bunting trouble on and the one be is getting instructions over

This trouble-finder is designed to lead the lineman directly to his trouble. He does not have to cut any wires but simply follows a small "finder coil" in the set until he comes to the point of trouble. In this way sometimes hours of time are saved, a big item to telephone companies.



Comfortable Working Chairs

THE factory worker is coming into her own at last. Rest-rooms and lunch-rooms have made her life sasier, and now Mr. William J. Koch, of La Crosse, Wisconsin, has invented for her an adjustable back-rest that will make her chair as comfortable M ABY

It is made of spiral aprings, covered with canvas, that are firmly held by brackets attached to the back of the The brackets can be adjusted to any width or height to suit the particular girl who then them. As she leans back the springs support her yet give her plenty of leeway. She is not apt to suffer from an aching back and the fatigue that usually accompanies it.

Barking the Logs—How It's Done

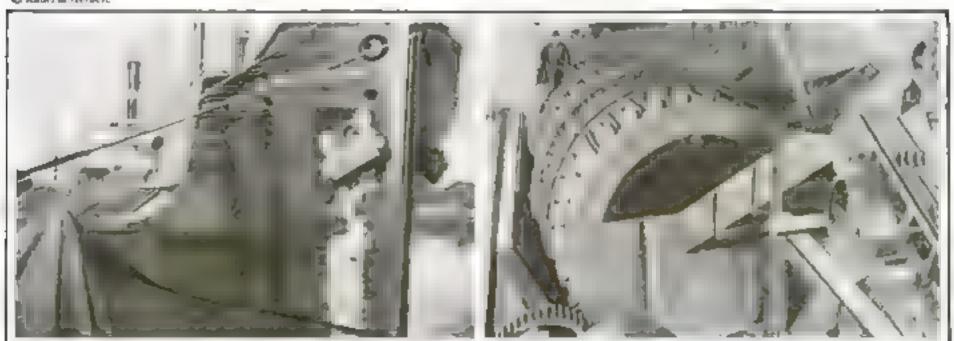
BEFORE logs are ground for wood-pulp.
the bark must be removed. In large paper-mills, where thousands of logs are handled duily, a very efficient process is used in the removal of the bark.

The giant machine here pictured is used for that purpose. The logs are brought to it on mechanical conveyors. When the drum in full, an electric motor turns it, and the great friction between the logs tears the wet back from the surface and they come out of the banking-drum clean and ready to be ground up

A single drum can handle several thousand cords of wood in one day. After the bark is removed, it slips out between the

The barking-drum is of the continuousfeed type.

C Kudel & Herbert





A Comb for Your Watch-Chain

"SILVER threads among the gold" has a new meaning. The silver remains the same, but the gold is represented by a comb with a gold back that fits in a gold case. And the case hangs at the end of a watch-chain

The fit is a close one, and there is no chance of the comb's shipping out of its rase, thus revealing its identity. Since it is about as long as your finger, it is no more conspicuous than a pencil danging at the end of the chan

In the flustration above you see one of these combs in operation. Note here the case serves as a handle



A HORSE will often neigh with joy when it sees one of its kind; but an automobile is not credited with any such emotions. Yet here we have a car that started to roll down hill when its brakes were accidentally released; it was traveling at a terrific speed and it suddenly swung round, leaped the curb, hurdled a two-foot show-window wall, and came to an abrupt stop directly alongede of another automobile.

Was it mere chance that led this runs way car to a garage? Or did it have plane automobile sense and realize that garage meant home?

The make of this remarkable automobile is not apparent; it is hardly to be guaranteed that the rest of its tribe would display the same amount of intelligence in son lar emerger eles.



The Town Pump Rebuilt on Scientific Lines

WHERE there is no running water and where the old-style rural pump was required to draw up the water from the well, this new type of pump has been installed.

In a clear glass tube from which the air has been extracted, the water is forced into the vacuum by the pressure of the atmosphere. As one turns the faucet and runs out some of the water from the tube, the water from the well is sucked back into the tube until a certain limit is reached, on the same principle as that which operates a suphon

How much easier is this method of getting water instead of the old way of tiring one's back by working the pump up and down, or of having to draw the water from the well with a rope and bucket, not to mention the greater cleanliness

Modern thought appears to be devoted to labor saving, either to earsely the manufacturer or to help the housewife



This Little Hen Broke the Record

THE spectacular Babe Rath has many namesakes in all walks of life. One of them is a white Leghors bent But she didn't receive that name for any "home run" proclivities; on the contrary, she remained close to the chicken "run" and laid ergs.

In one year she last three hundred and twenty-six eggs, completely breaking all previous records. That's why she was named Rube Ruth. According to statistics compiled by her owner, her feed

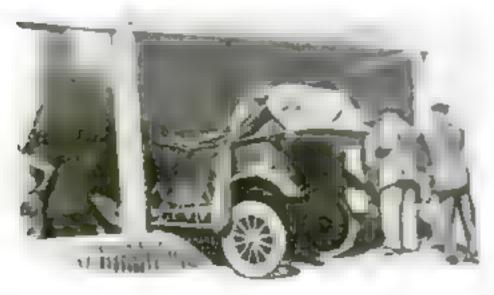
for the year cost four dollars and the eggs she produced were worth sixteen. Thus she brought her owner a profit of twelve dollars.

Old Airplane Parts in a Caravan

If you are one of the lucky mortals who can "go South" in the winter-time, why not get a light, comfortable caravan like the one below and live in it? The caravan is built on an axie and two wheels that were meant for an airplane. Many of these extra wheels and axies were left over when peace was declared, and such a caravan as this offers one way of using them

The body of the caravan is made of wood and canvas. Windows and ventilating holes in the roof will prevent the interior from becoming stuffy. There are four struts, one at each corner, which are lowered to support the caravan after an automobile has towed it to its final rectingulace

C Kedel & Herbret







A Japanese, Hat Used for a Lamp-Shade

WE have been assured that "a rose by any other name would amed as aweet," and a lampahade by any other name would not only work as well, but would probably cost considerably less. For lampahades have never lost the charm of high price unless they were made at home

Take, for example, a Japanese hamboo hat, it costs about fifty cents in the state top of a table samp and it will make a very acceptable shade that with park of you buy a ampehado for fifty cents? If you care to, you might line it with pink or amber or any suitable shade of silk to give it color.

A Japanese hat has still another use: it might be put over an open dish to keep the contents warm or free from dust.

Pushing the Boat Along

To push a boat from the back while riding in it is a feat accomplished by the novel device shown in the picture below. The paramen works a set of paddles that are attached to the stern of the boat and connected with a hand lever inside the boat.

The working backward and forward of this lever manipulates the paddles and furnishes beneficial exercise for the back and arms of the examinan

With such a device there is no danger of having the care mislaid or stolen, or of having them lost in the water. The paddles are hung on "hinges" which permit them to ply the water easily, and may be used both at a time or individually, as desired.



Abraham Lincoln Wore These Big Boots

SONGS have been written about Lincoln's gunboats, but not about his own boots. Burely they are worthy of comment; they are quite the most uncomfortable-looking boots imaginable.

Leather was cheap in Lincoln's time, and the shoemakers were very generous with it. The boots they made reached to the wearer's knees. He had to wear them even on the hottest days. As for shape—there wasn't much. A single strip of leather stretched from the tos to the center of the boot and then continued on up to the top.

Lincoln's boots were size fourteen, yet his feet measured eleven and a half inches Thus two and a half inches of space was wasted, while his big too had no place town

in this day of scientifically made shoes it is difficult to understand the endurance of our forefathers that permitted them to smile in such discomfort.



YOU will find that this little attachment to an electric meter will allow you to purchase a quarter's worth of current at a time. Quarter gas-meters have been in use for a number of years, but this is the first attempt to develop an electric meter to operate on this principle.

The quarter is inserted in the met and the knob turned in a left-hand direction. The meter will then allow twenty-five cents' worth of current to pass. When this amount of current is used up, the lights go out and another coin must be anserted.

This meter has been designed for use especially in number resorts, where there is a floating population. Electric-light companies have always had great trouble collecting bills from such localities.

To Jail by Airplane

A ERIAL policemen in San Francisco are thus far the first to make use of the sirplane to conduct a prisoner to jail, we the automobile petrol.

The sky route offers the most direct passage between two places, and in this instance the prisoner was transferred from the Alexandra county jall across the bay of San Francisco to the locality where an automobile patrol was waiting to continue the journey through the city. Where it is necessary to save time, the sirpiane can be of service, as in this case

When the air becomes crowded with machines, the arrest of violators of the air-traffic taws will undoubtedly become common and aerial patrols will no longer excite comment.

C Kadel & Her sert

C Kadel & Himsent



There Is More than One Way to Smuggle Jewels

But it takes a clever man to succeed



An expert arrugaler would know better than to roll his ewels into an elaborate cane-top impectors have long been approved of canes. Yet occasionally an amateur arrugaler will try to awag ger in with one

A good eight in sometimes a smoke and sometimes a jewel box. Here you see a eight which, when broken, revealed a large dismond The owner tried to amuggle it into the country, but the inspector got it first

The imaggler really has a difficult time thinking up harmless looking fixing places for his rubies and pearls. One man put them in his fountain pen, another a man wearing a peaked hat

a situate to the design of mile



Jewels and treathpasts who state and an art of the state and the state a

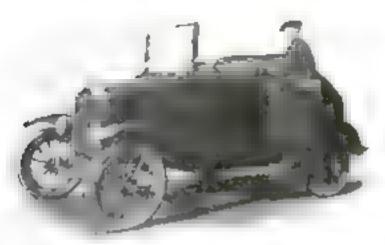


This camera may be perfectly isnocent, but the inspector looks it over very thoroughly. It has so many hidden corners

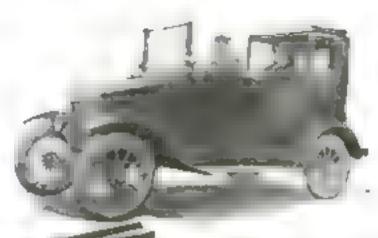
The rubber heel may have a little a vice a civer a but it's making up for it have the party of the country as a country as a cast the pearls resting and a cast the pearls resting

Change the Body to Suit Your Taste

No more family arguments over which style of car to buy



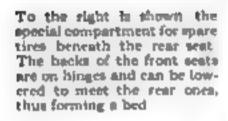
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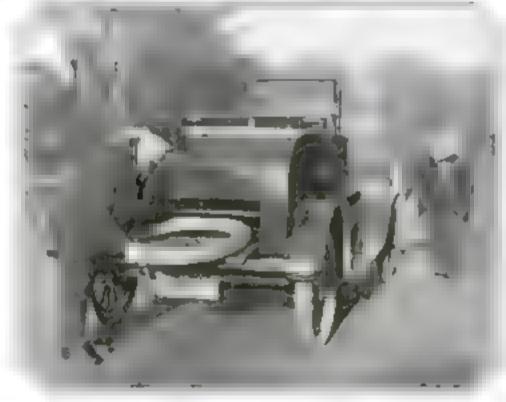
The car is here a full-fledged roadster. This is the form it takes when Mr McGuire rides to his office on a fair, warm morning. Mr McGuire has been a coach-maker all his life



Remove the front window-penes of the sedan, fold up the top, and you have an open touring-car with a sort of victoria top. This changeable body is mounted on a "flivver" chasses

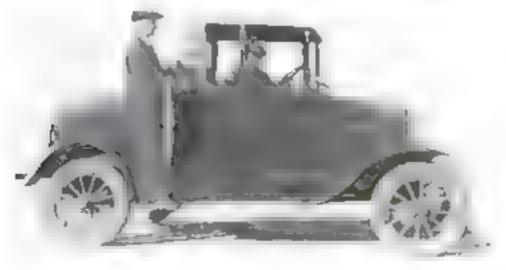


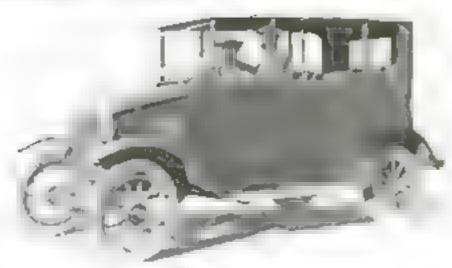
A coupe for two is illustrated below. It is made by resurrecting the back and aide windows and bringing them forward to the windshield. These windows cannot be opened from the outside, so when the door is locked, no thiel can enter.



'When a touring car becomes a roadster" is a suitable title for the picture at top center. The top is award forward until its edge rests on the back of the front seat. The rear cushions automatically disappear below when this happens

Below What is it? A sedant of course. But the inventor, Mr John J McGaire of New York has constructed it so that it can be transformed into practically any other type of car as the mood of the owner dictates.





The End of the World

Our sun may some day be a "new star" for the universe

A BLAZE of light flashes in the sky where perhaps no star was seen before, and a "new star" is heralded throughout the world. What does it mean? According to the generally accepted opinion of astronomers, nothing else than the end of a distant solar system, a cataclysm that has, at least temporarily, terminated the existence of a sun and its planets. Recent discovery has strongly confirmed this opinion,

All astronomical eyes are directed toward a new star when it appears, and the remarkable changes in its light and color are observed. Photographs are taken, and its spectrum, or color-band, is closely studied. Perhaps the star will have become so bright that it rivals all other stars and can be seen in full daylight. Gradually it begins to fade, usually changing from white to yellow, then to red, finally fading into a greenish nebula. This is the order usually followed in all the stars that are designated new, or temporary, stars.

Long before the invention of tele-

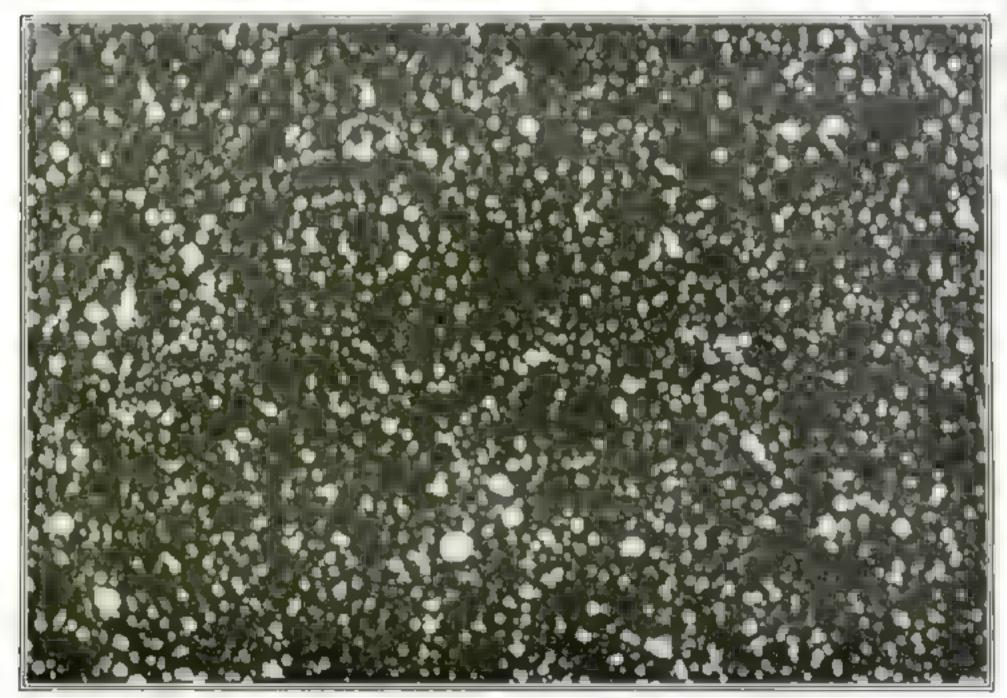
By Latimer J. Wilson

scopes the occasional flash of a "nova" attracted the eyes of people. Out of the darkness of night the brilliant new star seemed to flame, burning brightly for a few days and then sinking back into the depths of the unknown. What was a puzzle to the ancients, arousing only curiously and superstition, has become a separate branch of scientific research, and to-day the problem of the new stars is seemingly within the reach of our understanding

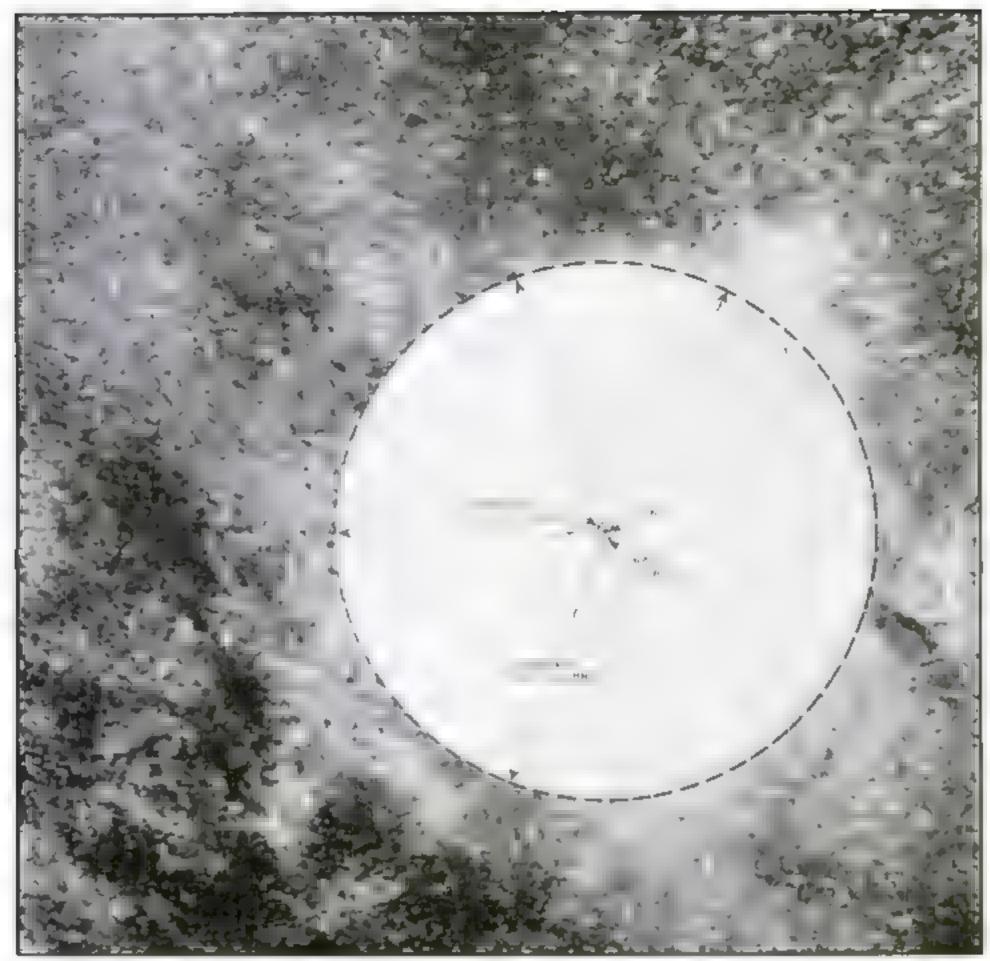
Nothing in history is more amazing than the explanation that the most exact of sciences often to account for the temporary stars. One of the most conspicuous "novae" of recent times was that which appeared suddenly in the constellation Perseus in 1901. It was a splendid object as seen with the naked eye. In June, 1918, another nova blazed out in the constellation Aquila. In each instance the star was actually seen to turn into a mass of luminous gas, a nebula; but the nova in Aquila has afforded the most aston-

ishing confirmation of the theory of such stars. On the eighth of June, the night following the eclipse of the sun, this magnificent star was discovered by every one who looked skyward. For several nights it was the brightest star. in the sky at that time, and in brightness second only to the brightest of alstars, Sirius. With the blue-white Vega and the pure white Altair, the hove of Aquila formed a gigantic celestial triangle in the summer sky. Photographs showed it on plates taken several nights before the date of its greatest brilliancy. In the interval it had increased in luminosity many thousand times. Prior to this it had regutered on photographic plates as an exceedingly faint star in the region of the Milky Way.

What is the meaning of these outbursts in the distant realm of the universe, and what import have they in the lives of men? To understand the meaning, one must understand the curious changes in their light as disclosed by the spectroscope. The spectrum of a bright hody is its light



Seen from a distance the sun would appear utterly lost among the stars of the Milky Way. This pictures a section of the spangled stream of the galaxy. The sun would be much closer to be thus seen than are any of the stars shown here



This indicates the speed of the masses traveling from the sun if it should in itset the new star in Aquila. The expansion of the materials of the outburst, following the terrific and instantaneous rush of light and heat, would be at the rate of eight thousand

miles a second. If a cloud were shot from the sun at a speed of eight thousand miles a second, it would reach the earth in four hours, and would fill the whole of the solar system within less than five days

spread out into a ripbon of color. If the body consists of a luminous beated solid, or a gas under great pressure, the form of this spectrum is a continuous color-ribbon, the color appearing in vertical bands and lines. A single element, such as sodium, when heated to incandescence, gives a single color, a double band of yellow. But hydrogen shows in the green, the blue, and the red sections of the spectrum. The electric are produces a continuous band full of rambow colors. The sun also gives the complete rainbow-tinted ribbon, but this band of color is crossed by curious combinations of dark lines. This was a puzzle until it was discovered that a tuminous body, when surrounded by gases of the same sub-

stances in a lesser degree of incandescence, suffers a partial absorption of light, thus causing the formation of dark gaps, or lines across the continuous spectrum. The sun is surrounded by these cooler gases, and they stop some of the light sensations, thus producing dark spaces.

These dark lines, by their position and grouping, show exactly what substances are involved in the incandescence of the sun and stars. When a bright body is surrounded by a blazing atmosphere of incandescent gas, bright instead of dark lines appear, and these also have the same arrangement in the spectrum as have the dark lines of the same substances. In the region of sunspots are both

bright and dark lines. Some of the games around or above the spots are at a higher state of incandescence than the gases within the sunspots. The displacement of these lines toward the violet or the red end of the spectrum indicates, among other things, motion in the line of sight. The principle is illustrated by a similar phenomenon of sound in which the sound-waves are crowded and shortened and rise in pitch as the object emitting them approaches us. Thus a locomotive whistle nees to a shrill shrick as the train dashes in our direction, while it falls in pitch as the train recedes. So the light sensations are quickened with the approach of their source, or lengthened in proportion as their source recedes from our line of sight,

This furnishes the key to interpreting the curious conduct of new stars. At first the color-ribbon is crossed by strong dark lines all shifted toward the violet or short-wave end of the spectrum. This shows that the gases surrounding the star are violently in motion toward us. Then, as the nova tlares brighter, strange bright lines appear. But they are wide and diffused, their centers agreeing with their proper place in the spectrum. Measure the width of these lines, and you find that they are extended both toward the violet and toward the red end of the spectrum, indicating that the luminous gases producing them are both approaching and receding a strange anomaly! How can these blazing gases in the far distant star be both coming and going at the same time? The answer is one of the most ingeniour pieres of reasoning in the whole field of astronomical research.

It assumes that the atmosphere of the new star is expanding in all directions around the core of the star in a bright shell of incandescent vapors. Hydrogen and belium are the principal gases involved. The motion in our tine of eight on the near side of the incundescent shell shifts the bright lines toward the violet, while the motion around this area is directed more and more away from us, causing a shifting of the lines toward the red. The rate shows that the expanding gases reach a velocity of nearly eight thousand miles a second. It is difficult to conceive of matter moving at such a speed.

Then the question arose, might it not be possible to detect this expansion of the star in the increased size of its volume as seen through the telescope? Ordinarily there is no star, except the sun, that shows a measurable disk. The face of distant sums is indeed too remote to be seen except as a mere theoretical point of light.

But this new star proved to be different from ordinary suns. Its explosion was of such an enormous extent that the star actually expanded until it reached a measurable diameter, and since the cataclysm first became visible it has continued to increase in size, though its light has waned, until to-day it shines only as a nebulous star that is just beyond the reach of unaided visibility. The measured rate of expansion proved to correspond to the spectral lines.

Nova Aquila now appears as a startike planetary nebula having a disk 3.8 seconds of arc in dismeter, appearing in telescopes to be as large as the largest of Jupiter's moons as

seen with the same glass. But in actual size it dwarfs into insignificance the vast space occupied by our sun and planets. The period usually required in stars of this sort to return to their pre-nova degree of brightness ranges from eight to fifteen years. This is exceedingly short when one considers the magnitude of the outburst.

Calculations show that the outburst of this star occurred nine hundred years ago. Light traveling 186,000 miles a second has been all that time reaching us from the region of the cataclysin which regenerated a faint sun into a new nebula.

If imagination be permitted to run in the fantastic direction indicated by disasters of such gigantic scale as that witnessed in Nova Aquila, might we not imagine a similar catastrophe befalling our sun in some remote future day? Perhaps the center of our solar system will suffer a similar convulsion. Something will let loose the pent-up energy of the star, rending asunder the bonds of gravity and releasing the compressed gases. In a moment the burst of incandescence would wither the earth and planets. In the distance across the ocean of apace, astronomers on some other world would see a "nova" in their sky, and it is not pleasant to think that we should be furnishing the spectacle,

Anybody Can Now Make Music Rolls

You don't have to be an expert planest to make music rolls for player-planes. Any one who understands time and rests can, by using the machine pictured, make his own rolls.

There is a note scale, on which treble and base notes are recorded. This scale extends the full width of the much beneath it the much roll paper is stretched. Perforations are

punched by a pointer that traves back and forth across the note scale. When you have located the note you wish to register, you move the pointer to it.

The time scale is at the left of the machine. the operator has adjusted the pointer on the note scale, he moves the note scale to the proper place on the time scale. Then, by pressing lightly on a punch button, he makes a perforation in the paper. If the note is to be held for several beats, he continues tapping the button, moving the note scale forward a notch at a time. This is repeated until all the notes in that particular section of paper have been recorded. Then the paper is released and moved forward and work started on a new section.

You repeat this action until the whole roll is perforated.



Present-Day Surgeons Must Be Good Carpenters

WE have wondered at the skill of surgeons in grafting pieces of skin from a frog's leg or from a human body upon the skinless injury caused by a burn or other accident.

But the marvels of modern surgery do not end there. "Bone" grafting is an art that demands the skill of a specialist in the most remarkable kind of "carpentry."

Electrically driven circular saws in the hands of a bone carpenter can now be used to slot, splice, and alter a fractured part of one's skeleton. Sometimes a part of the broken bone is neatly shaped and alid down into a slot cut into a part of the fractured member. Screws of steel, silver, ivory, or screws made out of the patient's own skeleton, are used to hold these jointed pieces firmly in place.

One curious result of these ingenious attempts is that of repairing an injured jaw. A piece of bone removed from the edge of a broken hip-bone was found to serve aplendidly when properly fitted into a man's broken jaw. This man to-day literally chews his food with his hip-bone—an anomalous situation indeed.

Never before in the world's history was there such an opportunity for bone carpentry as that offered by the war. The knowledge thus graned was not lost with the coming of peace

rolls with this new machine.

Sacrificing a Battleship to the Science of War

The old "lowa" is first to be made the subject of wireless-control experiments and then shot to pieces

THE most famous veteran in the United States Navy, the predreadnought type battleship lowe. now coast battleship Number 4, is slated for some experiments in wireless control, and then to be shot to pieces by the guns of the fleet.

At Santiago, under the command of "Fighting Bob" Evans, the lowa played a conspicuous part, giving the mortal hows to the Cristobal Colon with her forward pair of twelve-inch guns. in the great was she served as a training-ship.

The lows's guns and other valuable equipment are being removed and the coal-burning boilers are being replaced by two oil-burning ones, which facilitate control The weight thus saved will probably be used in modern deck armor.

The wireless equipment will consist of about the same apparatus as that used by John Hays Hammond in his wirelessly controlled boat a few years ago. This system was used by the Germans in their attack on the British monitors that bomburded their positions on the Belgian coast. Mr. Hammond is superin-

tending the instalment of the wireless

equipment.

When all changes have been made, the fowd will steam down the Chesapeake for some very thorough trials with her wireless control. It is desired that the ship shall be controlled alter-

nately from another ship, a shore station, and an airplane of scaplane.

After the wireless tests have been completed, the lowe will proceed to the battleship range and proving-grounds (arther down the bay, where her crew

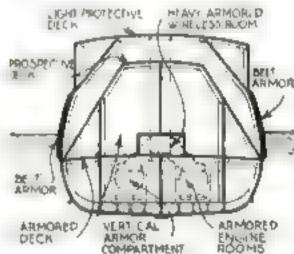
'Fighting Bob" Evens' famous old fows, which the Navy Department is preparing for very thorough experiments in wireless control #

will leave her. Control will then be taken over by a seaplane. The firing tests will be made as near to war conditions as possible." The lowe will proceed under her own power, when a squadron of destroyers will dash past her, enveloping her in a denise smokescreen. The battleship force will arrive on the scene and will begin firing. With a blurred vision at great ranges. it, will be almost impossible for the shells to hit their target except for the airplanes, which will spot the fire of the big guits. As each shell falls, its exact location in relation to the target will be radioed back to the pointers from one of the seaplanes.

While wireless control of ships dates from 1896, it is still in its infancy and must be developed for safety's sake. It is therefore reported that the battle-

> ship Ohio will be fitted out for this purpose

Still another ship, the former German dreadnought Ostfriesland, may be used as a target for the big guns. This German ship has a most complete system of internal protection and will therefore supply the needed example of deck pratection.

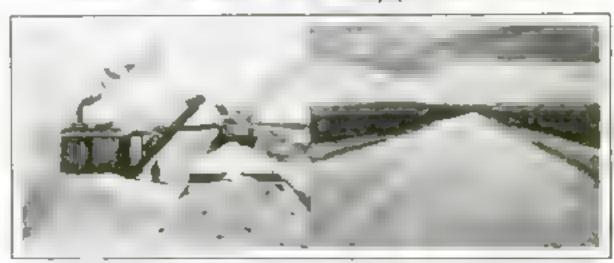


How the lowa is being refitted. The wireless equipment is about the same as that used by the Germans in their attack on the British monitors of Belgium

How a Road Was Built from Salt

OST road-VI building materlals are expensive. The people of Utah had millions of tons of good road material in their state, and did not know it

The Great Salt Lake washes upon its shores teemendous quantities of decayed salt. This substance was formerly considered a nuisance until a progressive contractor



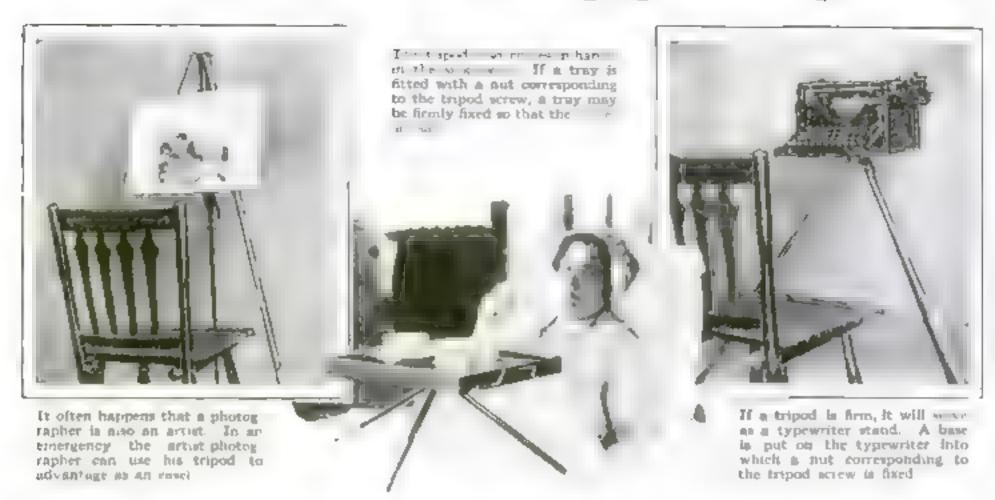
The steam-abovel is loading on restroad-curs decayed sait from the Great Salt Lake the picture opposite shows how it was used

Waste salt was discovered by chemical tests to possess excellent qualities for road-making purposes

discovered Its value as a road-building material, When properly treated it was found to have better wearing qualities than most.

After the tests, it was at once decided to build a link of the Lincoln Highway with it. A small railroad was run into the heavy deposits and a steam shovel loaded the care that carried the material.

New Uses for the Photographer's Tripod



Steel Structures that Have No Rivets

WHEN a New York company engaged in electric welding operations decided to erect a new building. Its engineers suggested that the structural parts of the steel framework be joined autogenously by welding instead of by bolts or rivets. They were confident that this method would save time and money.

As there was no precedent, the municipal authorities, when saked for a bunding permit, refused to issue it unless tests were made that would satisfy the building officials that a welded structure would be as strong and sale in every respect as a riveted structure.

Lap welds of various structural units were submitted to severe tests, the results of which were entirely satisfactory to the officials. They issued a permit for the erection of the steel framework, but insisted on a special test of the steel trusses of forty-feet span, which were to support the roof and the traveling crane of five-ton capacity.

Two trues units of the fan type and with a span of forty feet were set up, supported at their ends only. They were placed parallel twenty feet apart and connected by steel cross-bars. The test load, consisting of gravel in bugs, was piled in tiers on planking placed on top of the steel structure.

The trusses were designed for a live load of forty pounds to each square foot, each truss supporting a panel of eight hundred square feet. They were tested with a load of one hundred and



Steel framework of a b : mg can be welded together as a s as it can be fastened by bolts or rivers

a total load of freeight to the two trusses

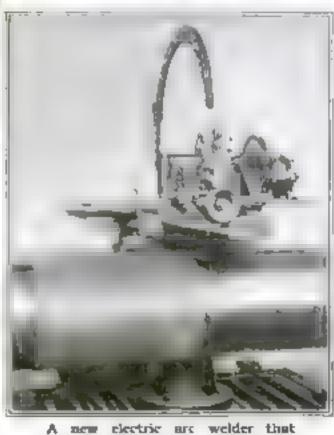
Representate a slit hudding departments in treater New York attented the to which gave the most satisfactory results. The defections caused by the load were carefully measured, and when the entire ment was removed two days later, it as found that, with exception of one single point, all parts of the trusses had returned to their original position.

Welding a Shaft with an Arc and a Steel Wire

THE new automatic are welder will weld away for hours without attention. It will mend broken search, plates, joints, and fractures.

It is shown weiding a steel wire to a shaft that was turned below size by mistake. The shaft is turned slowly and the wire welded to its surface

The ware is fed slowly by a small electric motor. It also passes through a simple straightener before it reaches the arc arthe surface of the steel shaft. When the wolding is done, the shaft will be turned over again to the correct size.



A new electric are welder that does its work quietly and efficiently

Saving \$7000 a Day with a Snow-Removing Machine

ICKNAMED the "snow-tank," because it looks somewhat like a combination of giant farming harvester, war tank, and tractor, this huge vehicle picks up snow and ice at the front and unloads it at the rear into wagons or trucks running along-aide in the same direction.

According to its inventor, Samuel Friedman, of New York city, it can load as much snow as eight hand shovelers in one twentieth the time.

The foundation of the machine is a four-wheel-driven motor-truck that can be run at a speed of from two to ten miles an hour, and that, according to its inventor, can load 1300 eight-cubic-yard motor-trucks daily if operated continuously and that number of trucks are loaded one apiece or a smaller number loaded more than once in rotation. When this is done, Dr. Friedman claims that the machine will save \$7000 daily as compared with hand shoveling.

How the Snow Is Loaded

The snow is picked up by means of two longitudinally inclined belt-conveyors, which carry it up to a boxlike compartment at the rear, where a second crosswise sist-conveyor automatically discharges the snow through a aide door into the body of a motor-track running alongs do the machine at the same speed and in the same

By Joseph Brunker

direction. Thus the entire snow pick-up and unloading is done mechanically. The longitudinal pick-up conveyors run continuously while the tank is in motion, but the crosswise conveyor is working only when the load is being discharged.

The entire mechanism is operated by a 150-horsepower marine gasoline engine mounted at the rear of the chassis frame. Only one power plant is necessary, since special clutches are provided for vehicle propulation, for the longitudinal conveyors and transverse conveyor. All three may be operated at once, or any one or combination as required. The longitudinally inclined conveyors at the front extend to within a few inches of the ground and are provided with heavy bludelike shovels on endless belts. These blades cut into the anow or ice and carry it up the belts as the apparatus moves forward. At the top or rear of the longitudinal conveyors, the anow is deposited into a hopper or boxlike receptacle, the floor of which consists of the transverse conveyor. The latter moves in either direction

As soon as one truck is loaded, it

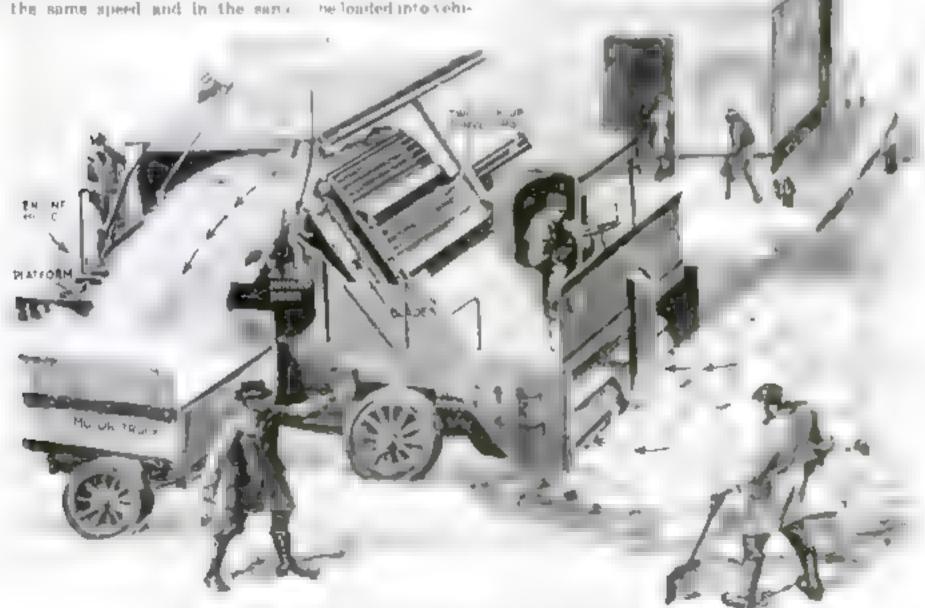
other truck times
the place. In the

cles but it is desired only to clean a path ten feet wide down the center of the street, one of the hopper side doors is left open and the transverse conveyor run continuously and the snow is also discharged continuously to one side or the other.

Doubling the Removal Capacity

One especial advantage of the machine lies in the fact that it compresses the snow in loading, rather than expands it, as is the case with hand shoveling. Due to the action of the longitudinal pick-up conveyor blades in raising the snow from the ground to the hopper, it is claimed that sixteen yards of snow on the ground are compressed to eight yards in the hopper. On the other hand, six cubic yards on the ground expand to eight yards with hand shoveling.

Three men are required to operate the tank, the driver at the front in his own cab to steer and work the propeiling clutch, and two other men, who stand on a platform at the rear of the hopper, one to control the longitudinal pick-up conveyors and the other to manipulate the crosswise loading conveyor



They call it the "most-tank" for obvious reasons. It scoops up snow and for and deposits it in a steady flow into a motor-truck running alongside at the same rate of speed

This Submarine Gathers Sponges

Long pincers reach out from the boat and bring them in

ITHERTO submarines have been invented and constructed for purposes of destruction. Their record in the great war, as every one knows, proved them an extremely dangerous weapon. But the submarine shown below, an invention of M. Raoul, a French abbé, is intended

sponges from the bottom of the ocean. It was built by a manufacturing company at Toulon, France, where it was thoroughly tested by submerging it to a depth of some three hundred feet in the harbor. It stood the test perfectly and returned to the surface without showing the alightest defect.

The Racul-Rembond, as the craft is named, has a length of about fifteen feet, and in salt water duplaces about 8 % tons.

It carries two persons. It consists of a steel cylinder with a diameter of approximately five feet, and has a rounded cap at each and. The submarine is entered through a manhole in the top, surmounted by a small tower

This opening can be hermetically closed by means of a cap, which may be operated either from the inside or from the outside, in case of an accident to the submerging and emerging mechanism. A simple turn of the handle of the closing mechanism is all that is necessary to lock or unlock the cover of the manhole.

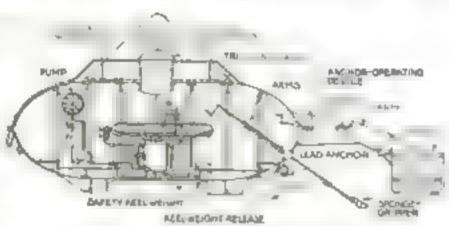
Construction of This Submorine

In its interior the submarine craft contains two reservoirs capable of holding air at a pressure of about 230 pounds to the square inch, and three water bulkheads that serve for submerging and raising the craft. Two of these bulkheads hold 250 quarts each, and serve to overcome the greater part of the craft's buoyancy. They are filled directly by the sea and are emptied by hand pumps.

The third tank, which is located in the center, holds only about sixty quarts. It receives its water through a tube connecting it with the sea, and is emptied by the compressed air contained in the pressure tanks before mentioned. Under normal conditions the craft is submerged by filling this third tank with water and is raised to the surface by forcing the water out of it by compressed air. For greater security, a lead keel, weighing about fifteen

By Jacques Boyer

hundred pounds, is attached to the bottom of the craft, and may be released from the interior in case of danger, to bring the craft quickly to the surface. In front of the craft a sounding-lead weighing fifty pounds is



Space is limited in this craft and this cross-section shows how compactly its interior equipment is arranged.

suspended, which may be lowered or raised by a hand windless on the inside to produce slight vertical changes of position

The submarine is propelled by two cars of steel, which are connected with the interior by a ball joint similar to that of the torpedo-tubes. The steel

rod of each oar has at its free end hinged wings which are so arranged that they push against the water in a direction opposite that of the intended motion of the craft, and fold up when they are moved in the direction of the bout's course.

How Sponges Are Gathered

In front of the keel is placed a broad wheel of moderate diameter, which, after the submergence of the craft,



Gethering a harvest of sponges grown by nature on the bottom of the sea, is the peaceful mission of this man-built monster

rests on the bottom of the sea and makes it possible to move the craft with the aid of the cars, without resorting to the tedious operation of lifting the hull by expelling part of the water in the ballast bulkheads every time a change of position is desired.

The apparatus for gathering the sponges consists merely of a pair of concave cutting pincers at the end of a telescoping steel rod which is oper-

ated from the inside of the craft and extends several feet beyond the bow. craft has a beaklike extension of steel plates in front, which serves a double purpose. It carries a group of incandescent lamps operated by electricity from a storage

battery, and supports also a large basket into which the sponges gathered are deposited. The spongegatherer in the bow carefully inspects the bottom of the sea within the radius of his lights. If he espies a sponge, he grasps it with the pincers at the end of the gathering-rod, tears or cuts it from its base, and deposits it in the basket.

The interior of the craft is illuminated by electric lights supplied by the storage battery already mentioned. and the crew may communicate by

> telephone with the consort ship.

Although the craft carries a crew of only two men, the supply of air quickly becomes exbausted. The installation of an air-purifying plant or of oxygen tanks is not fensible. The submarine must be raised from time to time and ventilated to prevent the men from suffocating.



Comparison with the figure of the man in the background gives a good idea of the size and proportions of the submarme craft

Maintaining the Water-Level of a Great Canal

IN building the New York state barge cangl much damming was necessary. Between Schenectady and Rome on the Erie branch there are eight huge dams of the so-called bridge type. They look like steel truss bridges except that there are no approaches.

The first step in making one of these dama is to build a concrete sill across

the bed of the river. On the down-stream side of these sills steel frames are built and they are connected with a bridgelike superstructure by hinges. In the spaces between the frames there are sliding steel gates which may be raised or lowered to control the flow of water through the dam. The gates are moved by chains wound and unwound by

electric winches in the bridge floor

During the navigation season the gates are down, but in the event of a flood they are raised to permit the escape of water. During the winter months the gates and the frames -they rest on the sill but are not attached to it -are raised to a horizontal position, thus leaving an unobstructed channel

through which ice and anow may flow.

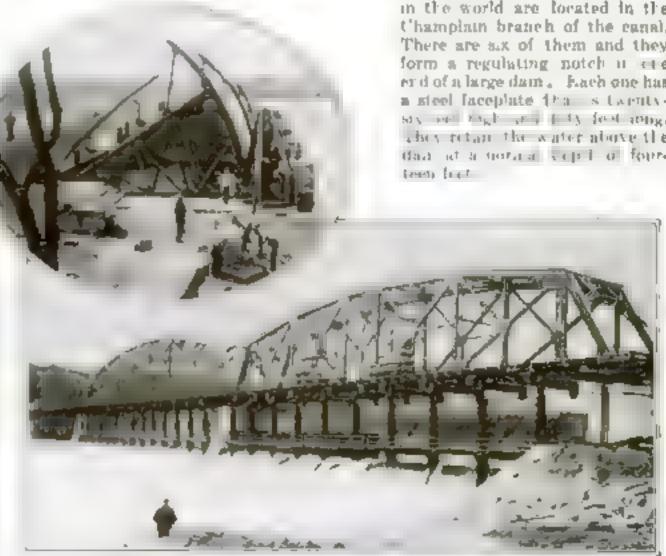
There are also dams of the fixed type which have movable sections for regulating the depth of the water. These sections are semicircular in shape; they are called sector gates. They are of steel and are counterbalanced by concrete blocks. Each gate rests on a wooden sill and is hand operated.

> The largest gates of this type in the world are located in the Champiain branch of the canal, There are alk of them and they form a regulating notch it cae er dof a large dam . Lach one has a steel faceplate that is twentysay one tack on a 1-43 feet arms. they retain the water above the daa at a norala copil o forr-Level (rees)

Two Years in the Life of a Salmon

CHINOOK salmon was tagged by mistake on August 13, 1918 at Whichey Island, Washington, Two years later it was caught in a shore trap in the Skeens river, Britis) Columbia. You will undoubtedt remember that Prohibition went into effect between those dates. Could the fish have been influenced by that"

At the time of the tagging the chinook salmon must have been quiteyoung, for it was mistaken for a sockeyé salmon. Thus at the time of its recapture it had not reached the spawning age. Then why was it near shore instead of out to sea? The Bureau of Fisheries is very much interested in the wanderings of this fish.



This enormous movable dam is located on New York state barge canal. Steel frames are hinged to the bridgelike superstructure, and they rest on a enderete sill. Above are shown the huge circular steel plates that are used as movable sections in an adjustable dam



A Pencil-Holder Made from a Piston

IF you want to must post in a second of was to as if

on the season a paperweight, a penejl-holder, and a ciga-

retto-holder, all in one. The small hole in the side of the piston, which was used to pin the piston-rod to the head, is just the right size to accommodate one's rigarette, though there is no place for the ash

Not only does this expedient serve as a pencil-holder, it can also be made to do

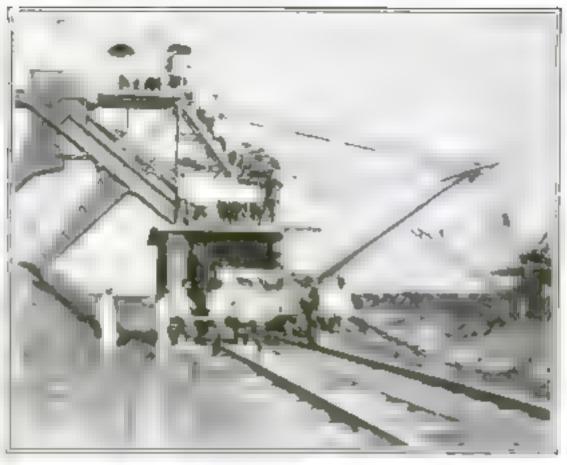
service as a flower-pot.

"To what base uses we may return," is probably the sentiment of the piston; but at least it is a use.

Men Who Repair Skeletons

THERE are two kinds of skeletonmenders—the bone surgeon and the skeleton-assembler. Art schools, medical colleges, and students of anatomy require an accurately constructed skeleton to aid in their work

All the nones must be properly asserted and carefully the transfer of an exempler must also pick out the dress of and somes that are at the two handred and mure house the are a table to the particular incoveroe be a sent at the properly of a sent an easy task, and the properly of a sent an easy task, and the properly of a sent an easy task.



Siam Adopte the Dry Dredger

REMARKABLE progress in the construction of roads in Sism is evidenced by the photograph reproduced above.

The log dry dredger in thoroughly modern and up to date. The endless chain of accopa digs up the loose ground or soil at railroad cuts. These accops or buckets carry the material guthered in by them to the acreens, where it is separated into sand and gravel which slide down in shoots by their own gravity and are deposited in separate poles.

The motive power is supplied by a gasoline motor. The bucket chain can be extended to a distance of about one hundred and twenty feet.

One of these large dreagers will remove and separate about two hundred and fifty cubic yards an hour

to design the second se



Colored Lights for Window Display

Window-Dress-Ers who with to introduce theatrical lighting effects can easily do no with the gelatine slide that fits across the reflector holding an electric bulb

The device constate of a metal frame that fits over the rim of the reflector. The geletine elide is supported in this frame by a netting of fine steel meah. The color of the gelatine will not fade by exposure to the electric light. The colored screens can be automatically changed, throwing red, blue, violet, green, purple, and yellow light upon the display. Artificial moonlight as well as golden sunlight can be imitated, giving a richness to the setting of the windows.

A Giant Mechanical Nuteracker

CRACKING walnuts is the job of this mechanical giant with its two "hands" baving fourteen fingers on each. These metallic hands constitute two units, each of which can be used separately.

The walnuts are dumped into a hopper at leasted 1 a leasted 1 a least of the high research characters a

the largest number of a section of a section







Typewriter Lamp Made from Speedometer Shaft

THE flexible covering which encloses the shaft of your speedometer becomes a valuable aid when you want to make a tamp for the typewriter. If there is not a discurded shaft-casing out is the garage, it is an ensy matter to get one from the repairman.

The typewriter lamp shown in the illustration was made from an old half "tree" used formerly as a hat- and cost-rack. Its arms or branches had been removed and the speedometer-shaft casing was soldered to the top of the tree. The electricity-bearing cable passes into the flexible metal casing, where it joins the top of the tree. The light can be easily adjusted

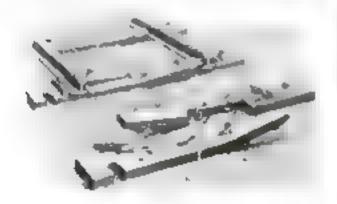
A speedometer shalt attached to any upright support mounted solidly can be adapted to making a table-lamp.

Two-Piece Railroad Ties

RAILROAD ties of special design have been developed to facilitate the erection of small-gage railroads on large construction jobs. The secret of the method has in the new tie, which is made of east iron.

Each tie is made in two ports and these lock together in the manner illustrated when the rails are laid. One end of each half is bent alightly upward so that it will brace the rails. The tiepieces also interlock when they are placed in the proper position. The rail is held securely against the bent ends of the ties by small from clamps that are holted in place on the outside. Means are also provided to drive stakes into the ground to hold the rails in place.

Hails laid in this manner may be taken up or changed in a very short time and with practically no expense but the labor



How We Look from Above

PHOTOGRAPHS taken from the air by aerial travelers show the ugly spots on the beautiful landscape made by man's artificialities. Houses resemble confetty scattered on a green rug; fields look like a crasy-patch quilt. Roads and paths are puzzles for Sherlock Holmes to solve.

Contrasted with these views, however, are many truly beautiful estates whose design ornaments the general landscape in a pleasing fashion.

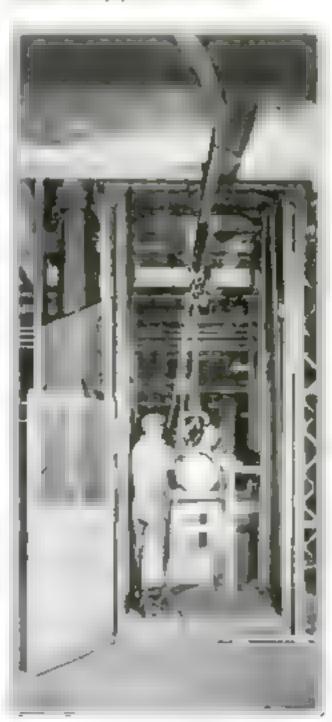
The new angle of view affords opportunities for the future landscape architect Cities of the future can be planned from the air; indeed, this method is already being used in planning the suburbs of some of our large cities.

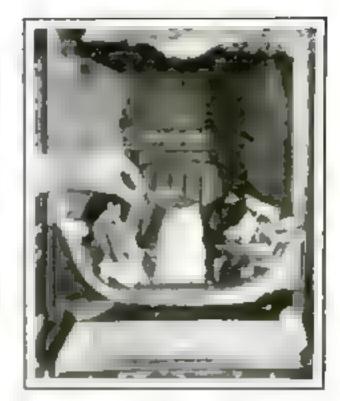
Coasting a Motor from Third Floor to Basement

SOME automobile factories assemble their motors on an upper floor, and then have them conveyed to the first floor or basement to be tested in the dynamometer

A quick way to get the motor downstairs is to "coast" it down on a cunveyor controlled by an air-operated device.

The conveyor is started in motion by a single movement of the master air-valve. An automatic tripper causes the carriage to stop at a designated point, where the monorail on the curriage engages with the main rail on the ceiling of the dynamometer room. From this position the load can be shifted to any point in the room.





How They Save Coal in England with a Flower-Pot

A FLOWER-POT will cut your coal-bill in helf! That seems rather strange, doesn't it? Yet many fellow sufferers from the shortage of coal in England have put flower-pots in their sloves and grates and are using half as much coal as they used formerly.

Before you build your fire, place an inverted flower-pot in the center of the grate. If your stove is small, use a small pot; if large, a large one. Then lay your wood and coal around it. When your fire is going strong, you will find that your stove gives out just as much heat as it did when there was no finwer-pot within

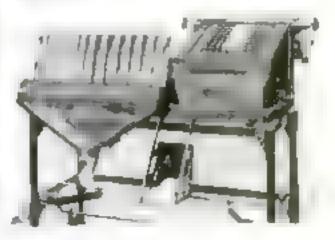
Should it happen that flower-pots are not much in evidence in your neighborhood, a brick will serve the same purpose.

Pay-Envelopes Filled by Machine

In using the new pay-roll machine this cashier first lists all of the salary amounts. When the last amount is listed, there is available, automatically added by the machine, not only the total amount of the pay-roll, but the exact number of each denomination of coin required for the pay-roll

After the schedule is prepared, the device is replaced by a coin-tray in which have been placed all coins, gold, silver, and copper. To the left of the coin-tray is a keyboard

As the amount for each envelope is called out, the operator presses the proper keys and pulls a lever. The machine automatically counts out the proper number of each kind of coin and drops them into the envelope. At the same time the machine makes a printed record of the amount.





Parkender de Parkers

Fooling the Rabbit-Hounds

SEVERAL dogs chasing one small rabbit—that was too much for the lumane societies of Oakland, California They protested against the inhumanities of coursing, and the result was the mechanical rabbit shown above

It is made of steel and wire, covered with a real rubbit's skin. It is attached to the end of a long metal arm and is criven by a five-horsepower motor. The rubbit can make a speed of forty-five miles an hour, and completely fools the eager dogs that pursue it.

Bees Eaten for Revenge

BEES are usually employed as manufacturers of honey, which is everywhere considered a delicious food, but there are places where the bees themselves serve as a food

The negroes of Guiana, when stung by a bee, proceed to eatch as many as they can and in twenge eat them. It would be interesting to know what bappens as an effect of the stings thus taken internally

In Ceylon the natives hold a torch under the beeswarm hanging to a tree, catch them as they drop, then carry them

A Daffodil Will Make a Novel Candlestick

nome, boil them, and eat them.

NOW that electricity has been installed in most city houses and has done away with lighting inconveniences, people are clamoring for candles! Gloomy candleslight when given off by artistic candles is preferred to the efficient glow of electric light.

Here you see an artistic candle in an even more artistic holder. Should you fail to recognize t, let as announce that it is supposed to look like a daffod! The flower itself holds the candle, and three of the leaves make the stand

The entre flower is made of metal and is painted yellow and green. Were it not for the sharp unnatural bends in the leaves you might mistake the candlestick for the real thing. This is adaptable to any flower with a deep corolla.



The Queer-Looking Twins Are Baby Alligators

THE man who took this photograph was a patient fellow. He waited several years before the event happened. He was on the job, however, and mapped this picture when the youngsters were a few hours old

Here they are, a couple of young alligators just out of their shells. They are not a bit rough, like their parents. In fact, they are so gentle and playful that children could have a good time playing with them

True, like the small, they cannot move very fast, but they get there. The one in the background has its mouth open Probably its mama has already given it lessons in the wonderful art of fly-estehing, since this is one of the delication in their diet.

Mail Your Letter on a Trolley-Car

"HELLO, what is your great hurry?" says one native of Hamburg, Germany, to another

"I want to catch a mail-box," replies the other, dashing off down the street at great speed

Mail-boxes are in the habit of standing still in the United States, and the above conversation would sound strange to us. In Hamburg and other European towns, however, the postal authorities have found it advisable to place mail-boxes on the back of the street-cars.

Food that Araba Eat

ARABS catch locusts, rosat them, pulverise them, and eat them as a pudding.

To prepare them for food, they dig a deep hole in the used and hulld a fire in it. On top of thus fire they throw bags of live locusts, cover them with sand, and build another fire on top. When they have reasted thus for a suitable time, the Araba take out the locusts and grind them into a powder, which they mix with water and eat as a pudding. Locusts are pests in border regions of the Sahara, but when other food is scarce, they are welcome.

An Electric Decorative Table Fountain

CONCEALED in the base of this fountain a small electric motor keeps the water in circulation. No water connection is needed, and the fountain, with the charm it lends to its surroundings, can be added to any during-tools, sick-room, or living-room by merely inserting the plug in the electric-light socket

The fountain is made of lacquered metal, rement, stone, or marble. It costs but a fraction of a cent an hour to operate, and there is absolutely no danger of its overflowing, since it contains only a few cupiuls of water

If this small fountain becomes popular, larger ones will undoubtedly be made. Perhaps they will take the place of the tall flower-pot stands that went out of style a few years ago.





Antwerp's Old Torture Pump

IN the Steen, an old castle in Antwerp, said to have been built in the ninth century, is a pump that dates from the gixteenth century.

The water comes from a Roman well as old as the castle itself. It was from this well that water was drawn for the purpose of giving the "water cure," the "drop by drop," and other fiendish methods of torture employed upon the unfortunate prisoners confined in the dark dungeons under the building in the dreadful days of the dark ages.

Note the remarkable leverage by which the piston-rod of the pump is worked up and down. As a vacuum is created the pressure of the atmosphere forces the

water upward.

A Huge Japanese Fan Blows Away the Chaff

MORE than sixty per cent of the population of Japan is engaged in the pursuit of agriculture, but there is room for improvement in their methods.

One of these is shown in the illustration. It consists of an old bellows fan which is worked to blow the chaff from the wheat

More than one million acres in Japan are devoted to wheat-growing. Strangely enough, even with the unscientific implements that are used, the soil of Japan ranks higher in general production than that of Italy. What could be accomplished by the use of modern time-saving devices can be imagined.

The law requires that all suitable land not used for other purposes must be cultivated, and if any remains idle a certain time the state makes plain that its owner is violating the law





The Concrete Garbage Furnace

Disposing of waste from the table and the kitchen is sometimes a problem that must be mot by the individual instead of by the community. When one lives outside the city limits and has not the benefit of garbage collection, he must get rid of waste products as best be can and with as little delay as possible.

The use of an outside concrete furnace, inexpensive in construction, solves this problem autofactorily. The quick fire made possible by the specially constructed flue burns the waste with the least effect of smoldering.

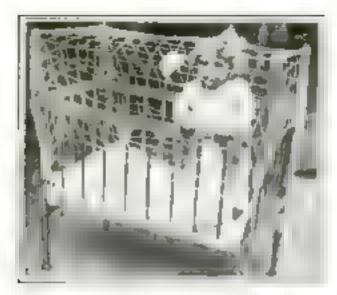
The fumes meane rapidly and are blown away, instead of remaining in the air, as they do when garbage is hurned in a heap in the open.

Starting an Exciting Hoople Race on the Ice at Lake Placid

TWENTY years ago every city child had a hoople, and chased it for blocks and blocks with a stick. But to-day you see very few; the danger of rubning into automobiles in undoubtedly the remon-

The children of yesterday, however, are grown upt wlay, and many of them at 11 ring to their housebeen instead of change their transport the constathey chase them across the constant A hoople rare is very exciting. The contestants are lined up at the starting posttion, and there is just enough space between them to make room for a hoople. If the hooples don't fodow the straight and currow path, they will callide and put their waves set of the core sequences are





Fish-Nets for Active Babies

If all people were as ambitious and persistent when they grow up as they were when they were babies, this would be a great world. Long before a haby's feet are strong enough to hold him, he tries to stand. Then, when he has finally learned how to stand and the newness of it wears off, he tries to climb If he does manage to reach the top of his crib, he will undoubtedly fall out and hurt himself

In an institution where many habies are brought up, this matter of climbing and falling saumes large proportions. Thus in one English babies' home all the cribs have fish-net covers. When the babies are awake the covers are fastened down.

The Stroke-Counter for Golfers

DO you play golf? Then you know how number of strokes in which you made each of the eighteen holes of an exciting match.

The counter in the accompanying illustration enables the guller who carries it to keep track of his record, hole by hole, with the least possible inconvenience. The counter resembles a watch with a dial on each flat side. Each large dial has nine email data, resembling the second-disl of a watch, but divided into twenty divisions. one for each stroke. In making the record, the first of the small dials, directly under the stem, indicates the number of strokes for making the first hole. At each pressure of the knob of the stem the hand of the digl moves one degree. It is assumed that not more than twenty strokes are required to make any hole



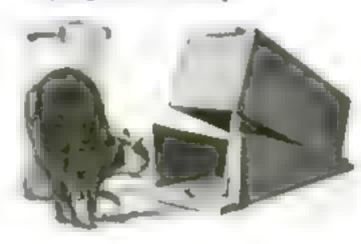
Trapping Vagrant Cats

RAT-TRAPS are common, but imagine

Such a device, for ensuring vagrant cats, has been designed and constructed by Ned Dearborn, of the United States Biological Survey

The trap is so preced as to pull the propunder the edge of the box when the latter is raised. As the cat reaches for the bart the treadle is tipped that springs the trap, the box falls, and a rod, coming in contact with the cat's back, releases an ounce of carbon bisulphid, which instantly and painically asphyziates the animal.

The authorities proclaim the object of the trap "for cutching vagrant cate and disposing of them humanely"



Rowing Twelve Miles an Hour with Your Feet

O¹ R logs are stronger than our arms.
Why not use them instead of our arms whethever possible?

That is the idea that occurred to the man who designed and constructed the host shown below. He drives it with a pedal arrangement similar to that on a blevele.

A regular two-blade propeller is used, which gives a speed of from ten to twelve miles an hour if a "busky" is at the pedals

Driving a boat in this way is very good exercise for everybody, and persons who like open-air sports will enjoy this one. The boat can also be driven in the usual way with a paddle or oars.





Use Old Automobile Cushions

CISHIONS that belped make your car an easy-riding one in its day should not be junked when the car is given up as lost by automobile doctors. Keep them: If necessary, re-cover them, then place them in front of an open fireplace

If you wish to toset marshinallows or roset popoors, you will have an excellent seat. By resting your elbows on your knees you knep your arms from growing tired while the rosating or toasting goes on

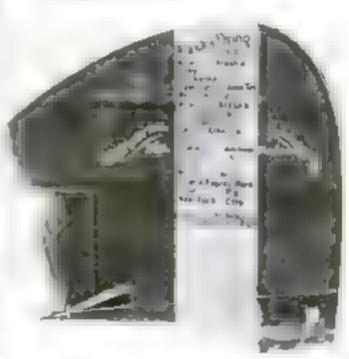
Any housewife could think of a dozen uses for old cushions, and for once the man of the house will agree that "that old junk" makes a welcome addition to a freezide seat in his smoking-room.

Planes that Went to Alaska

Business men of the future will probably own summer cottages in Alaska. The families will enjoy the delights of an arcile summer, and the husbands will take a "fly" up there to spend the week-end with thom, making the trip from New York in the Alaska Flying Express!

This is, of course, but a speculation of the future. That it is not an impractical undertaking has been demonstrated by the recent fight from New York city to Nome, Alaska, conducted by the United States Air Service in its memorable trail-blacing expedit or

The illustration shows the rudder of one of the three arplanes that made the flight. On it is painted the name of each stop included in the round trip and the pilot's and mechanic's names.





A Piano-Practice Keyboard

ON this new keyboard the keys have depressions in them. The inventor believes that these depressions will help piano students to develop better technique with less practice than is generally necessary to produce a good player. The depression in the center of the key trains the finger to strike the center of the key while playing.

By the continuous the of this key-board, the student will train himself so thoroughly that his fingers will strike the center of the keys on a plane without conscious effort. This is one of the requisites of successful playing and it has always been very difficult to master.

"Hustling" the Underground

LONDON'S "Underground" is a scene of rushing crowds and swift trains. The scramble to get abound at the station platforms necessitates having a man whose duty it is to prevent a train from stopping longer than its fixed time at any station

A special box is built for him; and, with his watch in one hand and the handle of a lever in the other, he keeps tab on the train stops. If a train remains longer than thirty seconds, he pulls the lever and this sounds a giron that warns the train crew that they must be off

In the New York subway a gong is sounded for the same purpose. With the burry and crowding always to be found in subways, the gong is the less nerve-racking algorithm.



How to Prevent Gas Explosions

Is city houses were equipped with an automatic device to cut off the gas as soon as fire reached the spot, probably many big fires would be prevented. Even a small fire that reaches the system of gaspipes in a building can gain momentum by the burst of flame that follows.

There is a device arranged on each floor which automatically closes the flow of gas. Soft metal lugs on a connecting lug under the ceiling of each floor melt at 150° F. This disconnects the rod, releasing the handle cock in the cellar, which closes the gas immediately.

It would seem a were law to make such a device compulsory in all large buildings



D Keystow View Company

Spreading the Whipped Cream

THE modern chef has created a fine art in making cakes, and for these delicious products of his art the public is willing to pay high prices.

The chef in a prominent New York hotel uses a "bag" funnal in spreading whipped cream over a case creation. This hotel takes good care of its employees in the culinary department, and if one of them receives as much as a slight scratch on the hand he is promptly attended by the doctor. Cleanliness as well as skill are the principal first considerations, and, wherever the process permits it, mechanical devices are used to prevent hands from coming in contact with food

Comfort Before Style in China

CHINESE women have not yet learned to ask for fur contain winter-time. In fact, they wear practically the same clothes in winter as in summer. In the most severe weather, however, they wear heating backets under their clocks.

These baskets are plain wicker once, such as we use for trash. Inside the baskets chargeal warmers are placed. They will radiate heat for hours. The chargeal is mixed with chemicals that generate oxygen, and thus the chargeal will hurn constantly even though it is sealed in the containers.

Looking at the picture below might cause one to marvel at the Chinese woman's seeming disregard for appearance, until the Occidental bustle and crinoline are recalled.



How a Five-Ton Elephant Learned Modern Dancing

One of the Hippodrome stars



George Powers, of the New York Hippodrome, taught five-ton Jennie, horn in India, to dance. He played a dance record on the phonograph until Jennie got accustomed to it, then he stopped the phonograph and lifted Jennie's front feet in time to his count



At first she did not realise that she had to sway her whole body to Powers' count. She thought it enough to sway her trunk and head. So he indicated to her what he espected by pushing her from side to side



As soon as Jennie understood that Powers wanted her to lift her feet in time to his count, she did it voluntarily. He guided her steps so that at a cost of much time and perseverance on the part of the man and the elephant, she learned just how to place her feet.



After her daily dance Jennie likes to shake hands with her master and dancing partner

dancing partner

She is immensely pleased when she has mastered a new trick and shaking hands is her way of telling.

Powers to



At last Powers turned on the phonometre again, and Jennie heard the exercische had beaud ausdern far an many days before her "dancing" lessons began. Immediately Jennie started to dance in time to the music. Powers took her by the trunk and danced with her She soon learned to match her steps to his



Jennie's reward is some delicacy she functes. Here Powers is giving her an apple. Powers never hurts or intimidates his elephants. He says as soon as an elephant understands what is wanted, the big animal tries its best to do it.

Some New Jobs for the Clothes-Wringer



If you have some hard nots to exack. let the gears of the wringer do the job for you. Place your adamant but be tween its teeth and give the landle a short, sharp turn. The meshing teeth will crush the shell

Pots and pans mean a great deal to many men who, before prohibition, kept out of the kitchen as much as possible. One of these men is here seen squeezing the junce out of a bag of fruit

perys mad the box and n ng to a through the

Tr. 15 1.6

and fry

Floors covering large areas can be elemned by an electric acrubbing-machine, which does the work of fourteen men

Scrubbing Floors Electrically

THE days of drudgery for the scrubwoman are numbered owing to the perfection of a new automatic scrubbingmachine. It is portable and is easy to operate. Attach the machine to any electric-light circuit and it is ready to use.

A large machine with three operators has cleaned 5600 square feet in one hour-work equivalent to that performed by fourteen handscrubbers. The work is divided into three operations. First there is the scrubbing-machine, operated by one man; next is the mop-man with a water-absorber tank and mon to clean the acrubber wheel-tracks and foot-tracks; and finally a sub-station, consisting of a weighted stand carrying an auxiliary cable for use where the cable on the scrubber is too short to reach from the furthest point to be acrubbed to the neurest hight-rocket

The machines can be equipped with different brushes to suit different kinds of floors.

An Automobile for One

O longer is it necessary to get out the big touringcar when only one member of the family wishes to ride. In the garage, or in the basement is a little vehicle that will convey a single passenger in comfort.

In a small space the complete mechanical equipment of an average automobile—the engine, gear-box, flywheel, clutch, and shaft-drive-is arranged. engine of 21/2 horsepower is of the standard two-stroke pattern, which has a heavy outside flywheel in which is housed the clutch, behind which is the two-speed car type of gear-box. The drive is taken to the wormdriven rear axle through a short shaft that runs into an aluminum casting containing the whole rear-axle equipment. The machine is started by a handle manipulated from the seat, and the control is from the handle-bara.

Economy of fuel, ease of travel, and apeed are combined in this adaptation of the motorcycle.

Traveling at thirty miles an hour this little machine can go more than eighty miles on a gallon of gasoline.



two - wheeled automobile." Above is shown the compact arrangement of the mechanism. At thirty triles an bout the trovrier can make eighty miles on one gailouss to noting

Driving a Car by an Air-Screw

MAGINE a streamined body of an aurplane running on three wheels, two in front and one in the rear, pro-

pelled by an airplane propeller placed at the front.

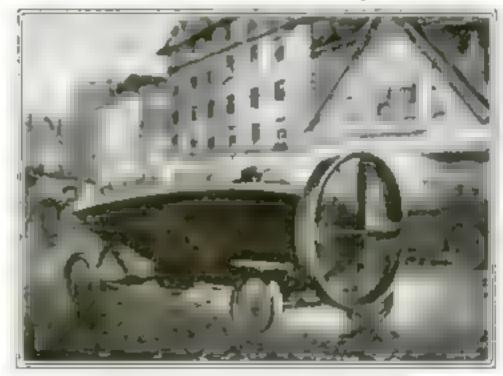
During the war the Germans employed airplane propellers for the propulsion of freight-cars. The land cur shown in the accompanying picture is the invention of Leyat, a French engineer. The body of the car, which is set on three or four wheels, is streamlined so as to offer the least resistance to the air. In the original model the driver accupied the seat in the front cab placed directly behind the propeller, while in the later models the cab has been abandoned and the driver occupies the cock-

pit with only his head showing above the top of the car.

The draving mechanism consists of

an eight-horsepower two-cylinder gasoline engine of the V type, air-cooled and connected directly with the four-

winged propeller. The engine is placed in the front end of the car, before the driver. Behind the driver's seat in a seat for one passenger, while the sharply tapering rear of the car contains a gaso...ne tank and space for tools and baggage. The rear wheels are used for steering, while the front wheels serve for braking the car. Tests show that a car of this construction can easily make fifty miles an hour, using about three quarts of gasoline. With the brake system used a car of this kind going at a rate of twenty-five miles an hour can be brought to a complete stop within fifteen feet.



A French inventor took a lemon from aviation and constructed. a streamlined body automobile carrying an airplane propeller

His Chance to Make Good

With burnt hands he plugged the roaring, leaking boiler

TACK HARDING glanced at every piece of machinery as he passed it → he had the born engineer's unconscious habit of taking in every detail. Nearing the switchboard, he noted the readings of the meters, then paused in the doorway of the fireroom.

The heat of rouring furnaces rushed out at him as he stood staring down

the tunnel-like space.

"Allen!" he called to a scantily clad, grimy-faced stoker. Allen, resting on his abovel, turned. "The chief had to go away," said Harding, "and he left me in charge. Is everything all right in here?"

The stoker cast a glance toward the boiler. He heattated uncertainly.

"I was just going to report that there is something wrong with Number Six boiler, sir. She ain't taking in water right."

"What seems to be the trouble?"

asked Harding.

"Something wrong with the pump," responded the stoker.

A Leak in the Pump

Harding entered the fireroom. On the right side of the alse was a row of huge black boiler ends. Across the way were the hunkers, piled high with good steam coal. Between each bunker and the one next to it a busy pump worked.

Jack Harding's eyes sought the

ing was at half.

water-glass of Number Six; the read-As he approached the pump that supplied water for Number Six, he saw that the steam chest was leaking. In While one man was drawing the fire, the other worked feverishly at the defective

Bu Edward J. Veronda

place of the steady clank of an honest pump, this one was sputtering and fuming crazily. The trouble was slight enough, but it must be remedied at once. If the damage was not repaired before the water in Number Six boiler was exhausted, the fire under it would have to be raked out. thus reducing the amount of steam fed to the engines. Some circuit would have to be cut out, and this would mean darkness in some part of the city that night—the very thing he had been given the opportunity to prevent!

Stepping quickly to the engineroom, he setzed hammer and chisel and hurried back to the pump.

Dropping on his knees beside the pump, he set to work. The narrow space cramped him, the escaping steam burned his hands; even the chinel grew so hot that he could hardly hold it.

And when he finally plugged up the leak the valve did not respond!

"Sha's Near Dry"

There was something more than a leak, he realized; the trouble must be in the valve itself.

"She's near dry," came Allen's swift warming. "She ain't safe!"

His voice was husky and his eyes measured the distance to the doorway. though beyond this he showed no sign of wavering

"Draw the fire," directed Harding. Despite this, Number Six continued to vibrate dangerously, quivering like an animal on the point of springing.

Down on his knees, Jack was pulling the pumps apart; his hands were burned nearly raw. And he raged when they fumbled. Probing into the pump, he found the trouble at last—a stone wedged in the valve! He picked at it with his fingers, then with a screwdriver-it would not come out! He got up, ran to the bench for a new valve, and hurried back. The ruined valve came away, and he inserted the new one, quickly driving in the screws.

The internal noise in Number Six was now a roar, and the safety valve let out an increasing scream. He tried to work faster, and as he worked he considered the matter a little hysterically, though his hands worked none the less steadily. Driving home the remaining screws, he forced the valve of the cylinder in place.

The noises from the belly of Number Six were dreadful now, and it was beyoud the power of man to listen to them with a steady heart.

As the boiler vibrated, the great steam-pipes vibrated with it. The walls of the building took it up and trembled also, not in unison at first, but finally in perfect harmony. Harding felt as if this vibration would drive him mad. His very bones trembled to the tone of the boiler.

He twisted the last nut, fumbled for the cock, and threw on the steam into the chest of the pump. came a gurging, choking sound, then a sharp click, the unmistakable noise of a working pump.

He reeled backward. "Is she work-

ing, Allen?"

"Sure," answered the stoker. "And if fire min't put under Number Six she'll be having the chills."

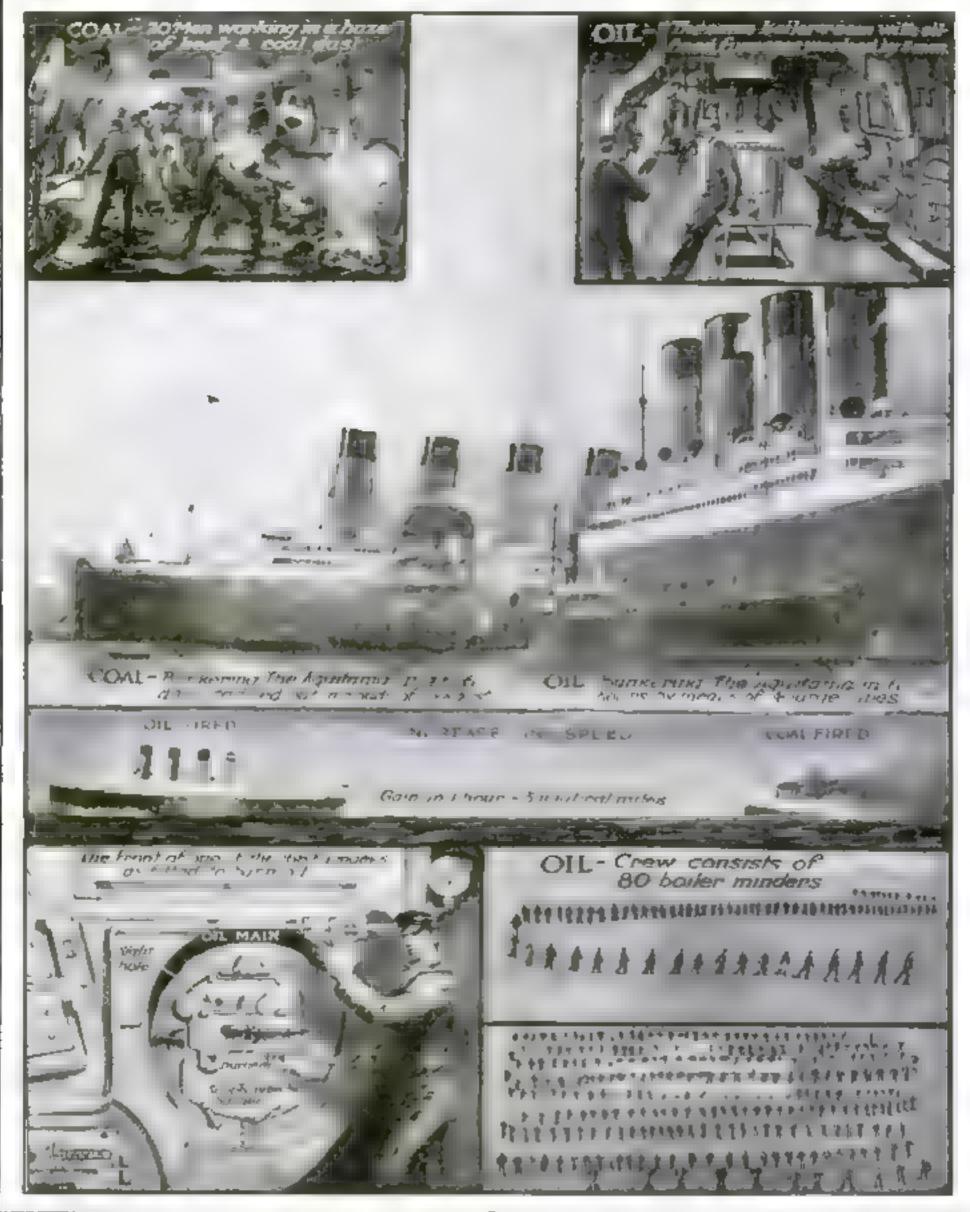
Jack stumbled out into the sunshine. He had made good-his opportunity was won!

valve. With scalded

hands he replaced it

fust in time

Installing Oil Fuel on a Great Ocean Liner



Modern Publishing Tompacy

Drawing by G. H. Davis

THE use of oil fuel on ships is, of course not new, but the conversion of the Aquitania into an oil-burning steamship is a matter of universal interest. It comprised the removal from boiler-rooms of ash-expellers, furnace fronts, fire bars, etc., weighing 300 tons. The weight of new material amounted to 745 tons.

The main storage tanks (in sections) extend along both sides of the ship for a dutance of 369 feet. There are also

three large athwartship tanks. The total storage capacity is 7780 tons of oil.

The tremendous advantages of oil over coal are graphically pictured in the drawing above. "Bunkering" is done in hours instead of days, the traveling speed is in creased, and whereas in handling coal three hundred stokers were formerly required, oil fuel can be taken care of by a crew of eighty boiler-minders.

Stage Settings from Blocks

A NOVEL but very effective stage setting first used in the production of French plays in New York city, was based entirely on a system of angles. When the stage director for the French Players in New York is ready to plan a scene, he goes to his drawing-board and draws a diagram of the stage. Then he takes pieces of dark-colored paper, cut in the form of squares, and fits them on the diagram until he obtains the effect he seeks. The little squares of paper are all cut according to scale, each square representing so many feet on the stage. After the stage setting is all worked out on the drawing-board, the director is ready to set the stage for rehearsal.

Once the preliminary work was done in the studio, it was only a matter of a few minutes to set the stage. Back of the stage are piled numbers of square blocks and several other blocks in the shape of steps. Two of these stephke blocks, fitted together, make one large block, about four times the size of the plain square blocks. Beside these curlous-looking blocks stand lattices, doors, and windows. At the back and at the sides of the stage are permanent wooden pillurs. The lattices, doors, and windows were so

made that they fitted between these pillars. They are all made in such a way that they are interchangeable. It is not necessary to have two sets of scenery, yet, when the stage is set, the scenes presented have an entirely different aplargrance.

This type of scenery lends itself to the production of both outdoor and indoor scenes. Almost any arrangement of a simple or formal garden can be accomplished with the blocks and lattices, while out of the combination of the interchangeable doors, windows, and blocks can arise a room suitable for a peasant's but or a king's palace.



Mr Barcroft of Cambridge, England, exercised on a stationary bicycle during his imprisonment in a glass case

In a Glass Case for Six Days

In the interests of aviation, Professor Barcroft of Cambridge University spent six days in a hermetically scaled glass case. Nitrogen and oxygen were constantly pumped into the case, but the amount of altrogen was increased while the oxygen was decreased. Thus the atmospheric conditions within resembled those experienced by aviators flying high

At the end of the rix days blood was drawn from Mr. Barcroit's arm and carefully examined. As for the effect on the experimenter, he became very restless toward the end. He was unable to sleep and lost his appetite entirely.



With these blocks is built up any scene that may be required, from drawing room to garden, from a peasant's but to a ling a palace

Mount a Flashlight on Your Automatic

"HANDS up! Quick!"

A flash of light envelope the would-be burglar and blinds him.
"Drop that gun!"

Dazed by the light, he drops it. His captor, in the meanwhile, is perfectly calm and sure of himself. The light that is blinding the burglar is a flashlight attached to his gun parallel to the barrel. Thus he knows that his gun is in line with the light

Furthermore, the flushlight is so.

The flushlight parallel to t





constructed that there is a dark spot in the center. As the light flashes on the culprit, the dark spot stands out and shows the captor just where his bullet would hit should be need to fire

The burglar knows nothing of the man who covers him; that man may be smaller than the burglar, or he may be much larger. In any event, the burglar decides not to take any chances and he therefore promptly gives up without a struggle.





When Inoculating the Pig

PERHAPS, at first glance, one would think that this was a device for pulling a pig apart limb by limb. It is not, however. It is merely used to keep the animal quiet while it is inoculated with an anti-choices secure by experts of the United States Department of Agriculture

Pigs are very susceptible to cholern which is a highly infectious disease, and a continuous battle is waged against it by breeders everywhere to prevent it from aprending.

Although the "operating-table" in the picture looks like an instrument of torture it is not at all painful, but effectively prevents the pig from equirming while the inoculation is being made. So tightly is the pig held that he cannot move an inch, all he can do is grunt.

Hooks that Will Hang the Picture Straight

ONE crooked picture will make a room look untidy. There is a new picture-hook that it supposed to prevent this. It is made of strong, flexible wire arranged in a series of loops, with a sharp point at one end. The point is driven into the wall and the loops are adjusted until the picture is perfectly straight in its place.

When you take the picture down and wish to remove the hooks, do not pull them out. Instead, pull the loops backward and forward a few times; they will break off and leave the stem behind them.

Ice-Pegs to Start Sleds

YOU don't need hills for boh-sledding if you are wishing to "peg away." Grasp and the second start of one of these contests for ladies. The onlookers anjoy it as much as the con-

Besides the excitement and pleasure in a race like this, it is also physically beneficial Both arms are exercised equally. There are few sports in which this occurs.

Gas from Peat

PEAT is now being used for the production of gas in especially designed producers. The yield compares favorably with that of coal, and many valuable byproducts are produced. This method of using peat has been found to be the most effective, since it is not necessary thoroughly to dry the crude material

Plants for the manufacture of gas from peat are in operation in Germany, England, Ireland, Sweden, and Italy



Removing a Double Chin

A DOUBLE chin is the deciding factor that places its owner in the heavy-weight class. It is the one thing most feared by women who have reached the stage known as "pleasingly plump."

Now, however, there is a double-chin remover which can be operated by the owner of the chin in the privacy of the home

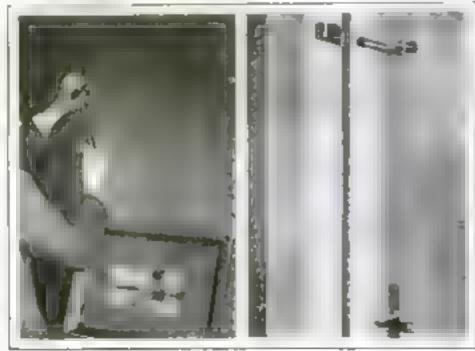
The machine is mounted on a small stand. Two wires extend from it to the sides of the band which the wearer straps under her chin. She turns on the current, and her chin in againsted, tries to fall back into place, and once more electricity has jumped into the breach and justified its value in the household, each year finding it more strongly intrenched than it was the previous year.

A Check to Keep Doors from Banging

THE east y attached doorcheck shown in the illustration will prevent the banging of doors

It commute of an arm bearing a spring coll ending in a soft cushion. This arm is plyoted to a base acrewed to the lockede of the door. The arm moves horizoptally only, and is held in position by a tension epring that can be regulated by turning a set screw

At the same level a clamp is attached to the door-jamb so that it is ready to receive the padded end of the door-check whenever the door is bunged shut.





Pictures Teach Dancing

NOW there is a moving-picture device to truch people duncing step by ster-

As exper dancer performs in front of a read greature machine, the area of the data a cost, even a sent in exactly forty two pictures. The pictures are enlarged and printed on paper. An outline of each picture is aketched a firm of each picture is aketched a firm of the sent are made. The printer of the proofs and these are used in machines like the one above

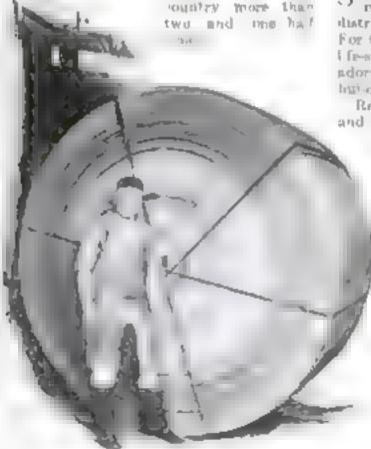
The pictures are placed in successgrooves in a drum that is rotated rapidly, producing the dusian of motion

The Largest Belt Yet

A RELT like this is used in conveying materials from one part is a large factory to another. It is the largest belt ever made for this purpose it is one thousand feet long and forty eight inches wide, and contains twenty-nine thousand feet of rubberned fabric. This is enough to cover the floor space.

of the largest gym-

PREMIUM



Harris 4 hading

Moving-Day for This Monument of Lincoln

SHORTLY after Lancoln's death a monument to him was erected in front of the district courthouse building in Washington. For fifty years this tall monument with its i fe-exact statue of Lincoln on top, has adorned the vicinity of the old courthousebuilding.

Recently the building was reconst a stand now the statue is considered to be out

of barmony with it!
As a result, the statue
a being moved to a
more appropriate
apol near the Potemar

Many of the remdents of Washington have protested against the removal, but what chance have mere individuals in an argument with a courthouse?



A Collapsible Cane

EVERTHING has a store and former who and one a store lie come at war and the come at war and a store who are to be a see to see the see to see

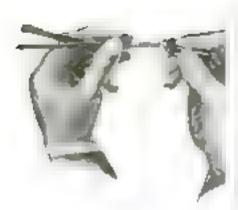
Checking Up the Coal-Dealer

T meight if his customer uses one of

The cond passes through a coute in

that is moved by the passing coal. A disrecords how much coal has been thrown down the chuts. On the device is arranged a counterweight that cuts off the passage of the coal unless a solid column is running through. If a small amount of coal ware allowed to pass, the vane would not operate and the dial would not register.

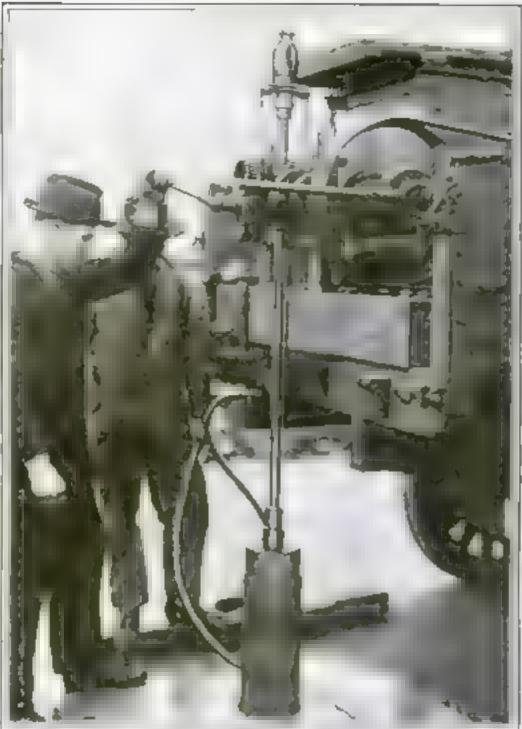




Rubber Caps Prevent Short Circuita

FLECTRIC wires can be protected from any posnibility of becoming grounded or from being short-circuited. This is usually done with tape as an insulator, but sometimes the tape is stretched until it becomes dangerously thin and, in time, more or less worn.

The danger of short-circuiting is entirely eliminated by the use of small rubber carseasily twisted over the spliced ands of the wires There are two sizes, and it takes on y almost three seconds. to put them on. When the tape is wound around the rubber cap, the insulation is doubly strong, and the chances of loss of current through contact with mobture or of chart-sizeuiting is entirely avaided by this simple method.





Carry Your Own Cigarette-Stand

F you go into a house where amoking is permitted but not induced in by the members of the family, you are not upt to find an ash-tray on which to park your

eighrette.

hat If you carry in your pecket the small eigsrettsstand shown above, you need not depend on the sah-trays of others. The stand is much of silver, and is no constructed that it will fold up and fit in your vest DOCKET

I afortunately, ac provision a made for the asless that are bound to full off the and of your eighrette; it is up to dispose of them would suggest o you need a small recobmay or vest pocket e, sa i fir your cigarotte

Drill-Presses and Production

CHOWN below are drill-presses that represent a radical departure from the ordinary type. The bushing-plates are attached to the drill so that they may be adjusted vertically. The jig, which holds the couting to be drilled, rolls on V-shaped rails from machine to machine

The first machine dolls the holes, the second reams them, and the third counterbores and countersinks them. A continuour procession of cautings passes under the dril.

At the end of the row, the finished casting is taken out of the jig, and the jig is returned on another rail to the first machine

Taking a Sample of Pavement

THESE men are not drilling a well sa you might think. No: they are obtaining a sample of pavement so that they may take it to a laboratory to put it under

This machine displaces several men working with pickases and chisels

The drill is made of chilled steel and has steel shot as its cutting medium. It is placed in contact with the pavement, fushed with water, and set in motion. It cuts a perfectly round hole, and the concrete from this hole is used in the tests that follow. The concrete is removed in the form of a core. This is tested for thicknem, wear, abrasion, and resistance.

A Mechanical Mule

IKE a regular mule, this mechanical " mule is driven by reins. The "reins" are really control cables that are connected with the electric motor that drives the mule. Instead of saying "Giddap," the driver merely operates a switch and the mechanical muss, untike its namesaks, starte off without any delay

This little machine is an infant mine locomotive weighing eighteen bundred pounds. It is but twenty-six inches high, and this enables it to get in parts of a mine where mules could not go. It will sleetravel over very light track, even though it

be poorly laid.









Is This a Boat or Is It an Airplane?

THIS looks like a cross between a Chinamun's junk and a scaplane. The electrical engineer who designed this mysterious graft refuses to tell the public just what it is all about. He has christened it the II hat-le-li. Everybody who has seen it is interested in knowing just what it is to be used for

The superstructure rests on three pontoons or floats. The stern float also serves as a rudder, and it is turned with

the wheel in the bow

The boat off we may call it such wis here shown starting on its trial voyage. It is a mystery to us, but we heartily wish the inventor every sucress.

Blowing Glass Eyes to Order

LASS-BLOWING as an art goes back to ancient times, but its application in making artificial eyes belongs to modern t mes. The art is delicate, especially in the matter of obtaining the right tint of color for the irls. Eyes that do not match are worse than none at al, so far as appearance is concerned.

The war caused a huge demand for glass eyes, and many manufacturers are kept busy making them

The enamel on the front of the eye must always be perfectly smooth or the eyelid will become irritated. When this enamel becomes worn, the wearer should get a new eye





A Hot-Swaging Machine to Make Heavy Tubing

MANY advances have been made in the methods of forming metals by coldswaging processes, but the hot process has been developed to be used principally on heavy work where a great deal of reduction is desired without annealing. A new machine bandles tubes as large as five and a half inches in diameter and solid rod of two and a half inches in diameter

As the spindle rotates, the hammerblocks are thrown away from the center by centrifugal force and the dies open. The twelve head-rolls project toward the center beyond the path of the hammer-black rolls and as the rolls pass each diametrically opposed pair of rolls, they are forced toward the center of the machine and carry the hammer-blocks and swaging dies with them. As the head rolls are passed, the hammer-blocks and dies are thrown automatically apart again-

The work is held rigidly and concen-

trically with the dies by pneumatically operated clamping jawa bolted to a saddle which moves forward and backward on its slideways by hydrause pressure. Feeding is controlled by a hand valve. The holder and cover are self contained and bung on a binge so that easy access to the dies and working parts of the machine is secured.

Diamonds Manufactured—This Time in the Movies

DON'T get excited. The diamond market is not wrecked yet. It will probably be some time before it even begins to totter. If mavie-mon really knew a process for the manufacture of diamonds, the production of movies would no longer interest them.

This formidable array of mysteriouslooking apparatus was assembled at great expense for a serial picture. From the movie-man's standpoint, the Illusion

is perfect

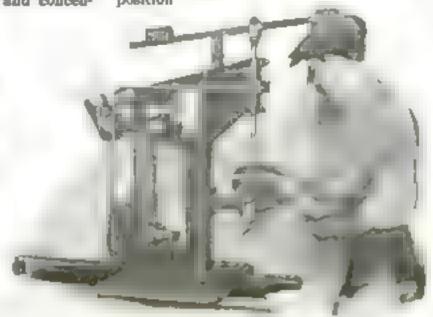
From the or entific man's standmint, it is just about what a movieman's idea of a diamond-producing apparatus would amount to.

A Drill-Press of Many Uses

IN place of the ordinary table, this little drill-press has a revolving member carrying on it different forms for the variour classes of work. There is a V-block, a cup, a point, an angle, and a flat table. Any one of these may be brought into posttion by merely turning the casting which is mounted on a shaft.

The moveble member locks into position when any one of the forms is in exact alinement with the drill in the spindle. A man is here shown using the V-block in drilling a hole through a rod. Pins, shafts, collars, balls, or angular pieces may be drilled by bringing the proper form into

position







Why the Chinese Are Cutting Their Queues

With the fall of the Manchu dynasty rame the wholesale barberner of queues. The parbers of China were vertically as do and their art is now do an ing to that of the necessity of the control of the necessity.

To combrate the fall of this dynastic rule the Chinese were sager to have their queues ramoved, after the lapse of three centuries

Skull Rock in Colorado

THERE are several famous rocks in various parts of the country that are chaped like the human head, but you must go to the Rocky Mountains if you wish to see a rock that is shaped like a skull

"Skull Rock." as it is called, is located near Canyon City, Colorado. It juts out from the side of the mountain on which it is located, and is clearly outlined against the sky

If Hamlet had seen this monstrous skull, how he would have soll analysed!

At Canyon City there is a road known as the "skyline drive." As you travel along it you see a range of mountains outlined against the sky. Skull Rock stands out sharply, with its eternal reminder of the transitorizess of man's life



Reserve Herber

Picking Up Marbles with the Toes to Cure Flat Feet

ARE you flat-footed? If you don't know, the next time you take a bath, observe the impressions that your wet feer make. If your feet are normal, there will be a parrise line from heel to toe on the nutside; if they are flat, the entire bottom of the foot will show

How can you correct flat-footedness? Buy a handful of marbles, place them in two rows, and start picking them up with your toes. To do this you must curl up your toes; as a result the muscles of the feet will be exercised and thereby strengthened.

The Old Horn as a Funnel

If the electrical end of your automobile horn is irreparably broken, find new uses for the various parts. Take, for instance, the cone-shaped horn proper. It may be used as a funnel

Your car is apt to run dry when you are miles from a garage. The nearest farmer will give you a pail of water, and the hemlunnel will guide the water into the radiator

How the Pioneer Automobiles Were Started

Pl Ther is gent and push. That's one of the remedies for a car that won't stark and a good old-lash-toned remedy too.

w. tin 1894. It is still in existe and in occasionally exhibited at the French automobile shows

The engine is full of life, even though it is more than twenty-five years old, and a few healthy pushes will start it off. The wheels are much larger than the wheels of the automobiles of today, and the tires are made of solid rubber. This automobile was one of the first to be built in France.

Beheaded by an Earthquake

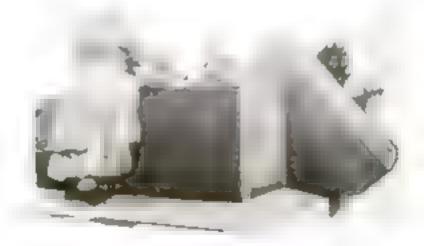
ONCE there was a woman who hated the thought of passing out of this world without leaving some concrete image of herself behind. And as she had plenty of money to satisfy her whim, she had the concrete image made. It was dressed concretely in clothes that were stylish at the time—a tight-fitting cost and a wide skirt.

For years, now, it has been sitting on the edge of her tombetone, which is situated in a Los Angeles cometery, holding a concrete satchel in its hand. Recently, however, there came an earthquaste which respected neither tombetones nor images. It knocked the head off the concrete woman, and deposited it alongside of the satchel.

"All the king's horses and all the king's men" will be needed to put her together again







It's Tea-Ball and Teapot Too

EVERY one knows that the flavor and color of ten-leaves will percolate through any perforated container, regardless of its shape, although heretofore a ball has been the usual shape

A tiny teapot, for instance, if properly punctured, will serve the purpose. Below you see
just such a teapot. It is
made of silver and
dangles at the end of a
small chain. The lid
opens to let in the tea.
If you hold it in a cup of
hut water for a few minutes, the water will become tea.



A Beer Sign for the Illiterate

LOOK closely at the picture below and you will notice a sign entitled "Bor es Sör," and above these words a picture of seven foaming glasses of beer, and a tray on which are seven beer bottles!

This store is located in Budapest a long way from the United States. The reason for this artistic beer display in that many of the poorer people in Budapest are unable to read. "Bor es Sor" would mean no more to them than it does to us, were it not for the picture



The Smallest One-Man Airplane

WEIGHING only \$20 pounds and costing only \$1200, the Pinchof airplane is said to be the smallest flying-machine. It travols the serial highway at a speed of 62 miles an hour and consumes but \$1.2 gallons of gaseline an hour

A machine of this type might approprintely be called a "runabout" of the air It might prove of practical value to country physicians whose practice is extensive

The small engine is a remarkable feature, while the small space taken up by the wings makes the plane easy to house.

Acrobatic Japanese Firemen

HAVING a population of nearly three millon people and with houses of generally filmsy construction, the city of Tokyo, Japan, requires a well drilled and efficient fire department.

Because there are no akysempers, the fire-fighting apparatus is temarkably simple compared with that of American cities. But the skull of the firemen as acrobate cannot be doubted when one witnesses them engaged in a practice drill

Here they are seen poised in difficult positions on the top of tall ladders, a feat often performed on the stage by Japanese acrobate in foreign countries. Numbers of us have seen these acrobate perform upon the top of ladders in an upright position.



He Put a Canos on a Chassis

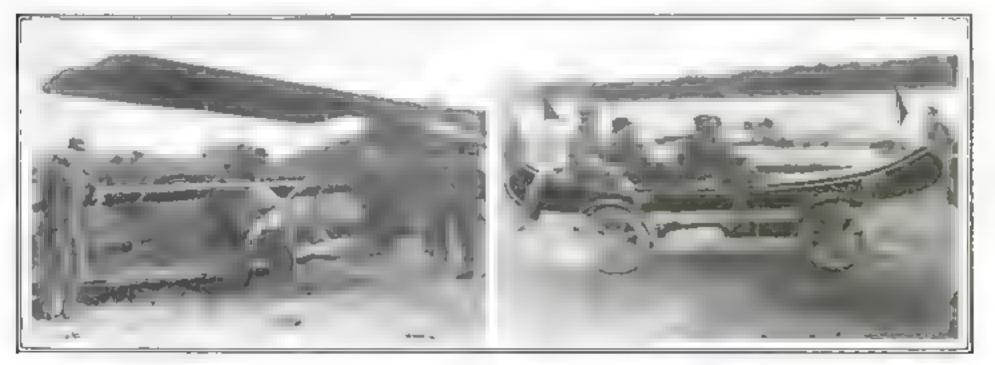
This is not an amphibious automobile, as you might think. It is merely an automobile chamis fitted with a cance-body.

The owner wanted something that looked different, so be bought an old cance and fitted it over the chants of his car in the manner shown. He not only had a cheap body but a car that attracted attention wherever it went. A glance at the picture, however, does not speak much for the comfort of this freakish-looking apology for an automobile. Its four passengers appear to be rather crowded for space.

Eye-Strain at the Movies

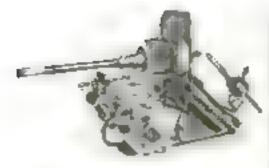
INVESTIGATION has shown that eyestrain in moving-pictures is often caused when one has to raise his head at an angle greater than thirty-five degrees to see the top of the screen. He should not have to turn his head sideways more than twentyfive degrees.

The body of the theater should have a soft, even light, approximately that given by a candle burning at a distance of forty degrees from the eye of the observer



Do It with Tools and Machines

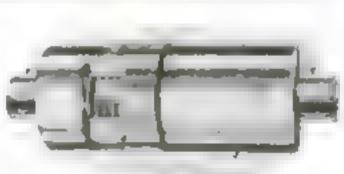
Industrial weapons forged by man's inventive mind



By changing the position of the carbon so that the are leaves its crater at an angle of 120 degrees, and by rotating the carbon rod, the spotlight illuminating power is increased 40 per cent



This multiple spindle drill press is equipped with a revolving table that indexes for each successive operation of rough drilling and reasing of connecting rods. The machine head is returned to position by air pressure



Flexible friction coil couplings make it possible to couple shafts with an offset of 'a meh or a deviation in alinement of 10 degrees



Clamp this rail-cutting ma-

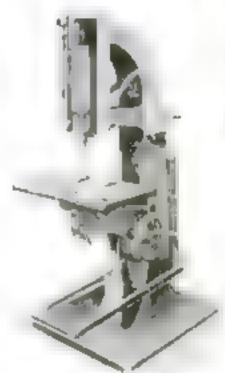
chine to the rail, adjust the

saw-blade, and turn the switch

of the motor; the machine

will do the rest

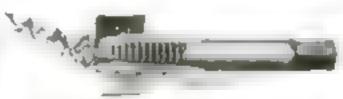
With a machine like this a workman can stemp the name of the manufacturer on 2500 pages of shoes in a single day



No belt is required for this drill-press, driven by a ver tically inpunted motor. The drill is attached to the shaft. A treadle controls the motion



One of the centerless cylindrical grinders will prove of great advantage in all cases in which accuracy and speed are essential



The first few teeth of this tap do the cutting, while the others act as a lead screw which removes the chips that would otherwise bruse the thread upon removal of the tap



If the side-cutting jaws of this plier become damaged they can be removed and a pair of new crucible steel jaws can be put in their place



This tool for beavy service on lathe, planer, or shaper is practically the equal of hand-forged solid tools, and is more economical.

Keeping Up with the March of Science

Facts for the man who wants to know

A Tree that Meets Every Need

IN the islands of the southern seas, the coconut pairs supplies all of the needs of the members of society. It supplies the natives with lumber to build their homes, their boats, and their utensils.

When the leaves of the tree are young, they are eaten. When they are old, they are woven into hats, clothes, baskets, bedding, paper, and thatch. The ribs of the older leaves are made into spears, arrows, brooms, torches, and paddles.

The flowers of the tree give the natives wine, vinegar, and sugar. The fruit of the palm yields oil, foods, cord, and matting.

It is said that even the roots are sometimes used as food.

The Scientific Koreans

An American missionary who recently returned to this country credits the ancient Koreans with being erientists and inventors. He claims that they used ironcind warships against the Japanese as early as 1597. They used cast type long before any other people, and they were employing guipowder as early as 200 B.C.

Their astronomers thought out the operation of the planetary system thousands of years ago. They invented the magnetic needle and were the first people to underglase pottery. They also introduced corpentry and architecture into Japan, and were the first to excel in the manufacture of silk.

Bronze and brass foundries were in operation in Korea at the beginning of the Christian era. It has been said that Korean engineers designed and constructed the great wall of China

What Makes Milk White?

HAVE you noticed that some milk is white, some has a bluish cast, while cream is yellow? Milk in a normal condition contains many milhous of minute spheres of fat, and these act as little mirrors, reflecting the light in all directions. The more numerous masses, as in the compact form of cream, produce an absorption of a part of the light, reflecting the yellow rays. When the masses of little spheres of fat are less numerous, as in shimmed milk, the liquid becomes more transparent, and as there is less reflection the color is bluish.

It is interesting to compare this phenomenon of light with the milk-white and the dull rings of the distant planet Saturn. Through the telescope this same principle of reflection from small bodies is apparent. The more compactly formed portion of the ring that surrounds Saturn shines with a pure white light. Here there are countless millions of little moons flying around Saturn, reflecting the sunlight as do the

apheres of fat in the rich milk. As these masses become less compactly grouped on that portion of the ring farthest from and that nearest to the planet, we can see the dark sky through the ring. On its inner and outer edges it is transparent and thus appears dark.

What Is a Dollar's Life?

A DOLLAR does not go very far nowadays, but the journey it makes must be a hard one if we are to judge by the wear and tear upon the big of the average dollar.

According to a table compiled by the Treasury Department, a dollar note lives but 2.03 years, while a silver certainate stays in circulation but one year. A five-dollar note stays in service 2.49 years, a ten-dollar note 8.57 years, while a twenty-dollar bill leate 5.94 years. A bundred-dollar note lives as long as 6.15 years, while, currously enough, a five-bundred-dollar bill lives but 2.78 years! But this is a long time compared with the longevity of a ten-thousand-dollar note, whose period of service is actually but 16 of a year.

The notes are by no means worn out in use, but are freely retired on becoming unserviceable

Radium Used in Pottery

WATER containing radioactive compounds is used as a curative agent for certain illnesses. Mere contact with such compounds for a sufficient length of time will make water slightly radioactive.

Pottery is now manufactured which has in it a small percentage of radioactive material. This is mixed with the clay and baked in the kiln. Water left in pottery of this nature for a short time will become radioactive by "Induction," and a health-giving drink is made.

Such water may also be employed in the watering of plants with good results, since the presence of a radioactive conspound near the roots of a plant is very helpful to its growth.

Do Frogs Like Music?

DiD you ever wake up in the country, on a summer night, and hear the frogs saying brochant? Probably it would be more sensible to ask if you managed to get to sleep while they were croaking

An Englishman claims that from can be charmed with music in much the same manner that a snake may be charmed. He tells of having held four from absolutely spell-bound with piano music

Science has made another great decovery, and it may be of some benefit to mankind.

Moisture X-Rays the Wall

of your room and see if you can locate the skeleton of the lathes back of the plaster. If the room is of an table location and temperature, the phenomenon can be observed. Investigation shows that the black markings are the spaces between the lathes, just as one might look between them into the dark shadows of the attic above, or the dark background between the plaster and the outer wall. Curiously, this effect cannot be observed in interior rooms, or upon the calling of a lower room where the upper part of the house is kept warm.

Temperature and moisture are found to be responsible for the effect. The warm air of a room contains much moisture and also fine particles of dust. The attic is usually cold, as also is the air-space back of the planter of the outer walls. This causes the moisture to condense on the spaces between the lathes where the temperature difference is greatest, and in condensing it deposits the particles of dust

Making Use of Lizard Skin

THE lisards of India—and India has a great crop of them—are hunted for their skine. Women's and children's show, purses, and handbage are manufactured from them. These articles have been found to wear as well as calisism or glace kid

The average skin is two feet square and is worth thirty-two cents. A pair of shoes made of heard skin costs four deliars.

Why Plants Freeze to Death

FOR scientific as well as for practical reasons, the question as to the exact manner in which the death of plant life is caused by freezing is of great interest to scientists. A number of explanations of the phenomenon have been given

Some investigators were of the opinion that the freezing or crystallization of the water contained in the cells caused a disruption of the plasma membrane, which is extremely sensitive. This theory was not accepted by others, who maintained that, the plasma being a viscous liquid, it may be assumed that the membrane would be able to yield sufficiently to avoid rupture.

Other investigators claumed that it was not the freezing, but the thawing out, especially rapid thawing, that destroyed the cells. This opinion is correct only in part. It is undoubtedly true that rapid thawing may destroy frazen cells which with gradual thawing would have survived.

The problem is greatly complicated by the fact that certain plants survive even a severe frost and revive after they have been frozen hard and stiff for a considerable period, while other plants, especially those coming from the tropics, are killed by temperatures only slightly above the

freezing-polut.

A new theory assumes that the freezing removes part of the water contained in the colloidal living substance, and that the water thus separated cannot again be absorbed by the colloid. Another effect of the freezing undoubtedly is that mineral salts, sugar, and other substances contained in solution in the cells are deprived by frost of part of the water in which they are dissolved. The solution hence becomes too maturated

Indurectly the front injures plants if the ground in frozen hard, while the sun keeps the plants themselves below freezing temperature. The roots and rootlets, frozen hard, are unable to supply the plant with water, and the plant witte. Severe cold may cause disruption of the cells in the interior of the plants which in some cases may cause the death of the plant by the drying up of the injured tissue. Trees are often split by extreme cold, but otherwise healthy trees are seldom permanently injured by the cracks.

Ancestors of the Big Trees

AMPLE evidence is to be had that Cali-forms's great trees, the sequoiss, whose first aprouts appeared above the soil at least seven centuries before the advent of our Christian era, are the survivors of a widely distributed race that mulijons of years ago spread over a vast area of the world. Probably more than eight million years ago these trees, the redwoods, were leaving their time-resistant cones as records which to-day are unearthed as fossile. Beneath their lofty branches grant reptiles crept or flew

The uncestors of our sequence towered shove the ferny underbrush that preceded modern pant life. There were no flowering plants in those days; they developed later, and are the food sources of civilized man. In the shade of the great trees the grant reptiles came and vanished, the little five-tood horse developed into the modern horse. The race of trees survived and watched the evolution of the whole animal species up to the ago of man. What a remarkable history the redwoods could tell

of life on our planet!

Watch New York Grow

THE 1920 Cenaus Report shows that New York city has within its limits 5,620,048 inhabitants. This means that in the past ten years \$53,166 strangers have come to the city to live-a rate of more

than 85,000 m year

This increase, averaging mure than 17,000 families of five to the family, means that 142 apartment buildings, housing 129 families, would have to be built each year to house all these newcomers. This has not been done, bence the serious lack of housing that threatens the great city

In New York state there are now 10,384,-144 people, an increase of 1,270,530 since 1910. It can be seen that New York city has gained practically two thirds of this increase in the state's population.

Cement Joints for Iron Pipes

TEAD is usualty employed to make joints in east-iron water-pipes. Lead has recently been replaced and cement has been brought into use as a substitute.

This experiment was conducted by a water company of San Francisco, California, and it is claimed that a great saving has resulted. The cement can be rammed in place much more easily than the lead and considerable reduction in cost 😘 effected.

Animals that Glow

AMONG the interesting phenomena of organic life is the luminoscence or phosphorescence of certain animals and plants. The light-giving power of so-called lightning-bugs, of certain organs characterutic of deep-sea fishes, of certain microorganisms that cause the phosphorescence of the sea in tropical and sub-tropical latitudes and of decaying wood belong in this

It was originally believed that the glowing and decaying wood was caused by some chemical process of decay; but recently investigators, among them Brefeld and Moliach, ascertained that the myrelium of certain fungi of a low order produces the phosphorescence, and the decaying wood is concerned in the process only to the extent of supplying the nutriment for the development of the mycelium

The exact process of light production has not yet been ascertained, but it is known that only in the presence of free exygen in the phosphorescence at all

According to the theory advanced by Moljach, the cells of the myrelium produce a substance that he calls photogen and that gives light in the presence of water and free 033 gen

Saturn without Its Ring

THE man in the street may notice the planet that some one has pointed out to born as Saturn. He has heard of the remarkable flat ring that surrounds this distant world. If he takes a look through a telescope any time until February 22, expecting to see the ring, he will be disappointed. On November 7 the earth passed through the plane of Saturn's ring, and now we are on the unilluminated side of it and can see only its dark shadow where the ring growes the ball of the planet.

It takes Saturn almost thirty years to make a trip around the sun, and twice in that interval the earth passes through the plane of the ring. The event is of much interest in attempts to solve some of the problems concerning its structure. With a large telescope a very thin hright line can be discerned at the time the ring is exactly

edgewije toward un.

The Pale Eyes of City People

PROLONGED absence of sunlight tends to produce pale hair and colorless eyes. Both vegetable and animal coloration depend to a proportional degree upon direct minlight. Note the albino fish of caves, the white aboots of plants eternally shielded from the sun. In like manner the eyes of a human being would become less rich in color, as also would the akin and buir, if he lived constantly in deep shadow.

Based upon this theory, one might expect the dwellers of city apartment-houses eventually to develop these characteristics to a degree. A French professor has told the Academy of Sciences in Paris that after long residence in the city an individual's eyes grow paler and the hair undergoes bleaching. Dark eyes are less sensitive to light than puls ones; hence the dark-eyed people of the nunlit tropics are better able to endure the stronger light without pain.

The Life of a Star

IP we examine the light of a number of stars, some will be found to be white, othern yellow, and still othern red

In certain white stars hydrogen and belium gases are conspicuous, and there is little indication of metallic elements. These are the youngest suns of the universe. In another kind the helium is less pronounced and the hydrogen is strong, while the metals have made their appearance. In still another kind, such as the sun, the metalite elements, such as fron and titanrum, are present in the atmosphere of the

At last we come to the kind of star that shines with a red glow, and whose atmosphere contains metallic compounds, ox

ides of metals, and cyanoger.

There are many reasons for supposing that a star is formed through the condensafrom of primitive matter diffused throughout space. Commetly forming under gravity, there are frictimal shocks and collinions that greatly rules the temperature of the mass. The star grows hotter as it becomes more compact until the heat produced becomes less than that radiated away through space. Then the star begins to cool until it finally becomes extinct and dark

Buying Scientifically

'HE engineer or architect must be continually on the lookout for errors arising from the use of unstandardized material His specifications may permit the use of several kinds of lumber, but he is at a disadvantage because he has no means of knowing from what region the wood will be secured, and therefore what sizes will be beilggun

This frequently is the cause of discrepancies and maccurages in his dealgn. The technical man becomes fammar with grades "X, Y, and Z" of a certain species of lumber. There comes a time when he is unable to secure that species and has to use the same named grade of some other kind of lumber. This he may find totally dis-

similar and unsuitable.

There should be a national instead of a regional standardization of sizes and grades of lumber. It would result in greater efficiency in distribution and use, reducing the cost of labor in handling and simplifying the lumber-dealers' multiplicity of stock items.

Housekeeping Made Easy

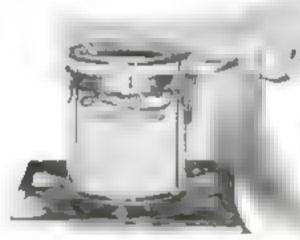


Here is a wooden tie-stretchertwo arms hinged at one end. You slip it into the tie, spread the arms, and hold it over steam



This is the new electric floor-polisher. A small motor revolves at the rate of mar. I subset

What can you do when a nall-hole outgrows the nail? Wrap some cotton around the nail and soak it in glue. Then put the nail back



and since you to be and with it a cree we be said



To prevent a glass utenell from cracking when bottom liquid in pan cash shy a stee a nee mile it

Need some new anacepans? Buy, instead, a detachable handle and adjust it to an old can. In this fashlon you will have as many saucepans as you have cans.



Hang your froning-board on the door. There is a metal holder with hinged arms that can be adjusted to fit any ironing-board



One of the best things a spool does is to roll. But this new holder attached to a safety-pin enables you to fasten the spool to your dress while you new



How can you prevent a box of eigers from going dry? By placing a small water-soaked porcelain block inside the box. Thus white block is enoned in rubber



Don't wrap a cloth around a bot dish when you wish to carry it to the table. Rather, place the dish in a wire frame like the one above, and protect both dish and table



She lowers the mop into the wire basket, slips the half ring over the mop-handle, and pulls the handle forward, squeezing out the water



The scoop of the body is pushed back by the truck into the material to be loaded and the load is automatically taken aboard

A Motor-Truck Body that Loads Itself

COMETHING new in the way of so that the body is lowered gradually. self-loading motor-truck bodies has recently been invented by Frederick Wengraf.

The body of the truck is mounted on rollers, which run in special tracks on the truck chassis frame and permit the hody to be pulled backward off the chassis on to the ground by means of a cable and drum operated from power taken from the regular truck engine. The rear end of the robers curves down

Handcuffing a Car to

Prevent Theft

past year or so. Among the many devices that have been invented to combat their depredations, one of the most effective is a veritable handouff which is fitted around the vertical pln of the steering knuckle and locked in page so that the front wheels can turn neither to the left nor to the

The apparatus consists of two hinged steel jaws with wedge teeth. A doubleheaded bolt operated by a special lock holds the laws in place, thus making the steering knuckle rigid.

The entire mechanism can be carried

in the coat pocket when not in use and

can be locked to the steering-wheel or

taken off in a few seconds.

right.

UTOMOBILE thieses have been more and more reckless in the

When on the ground, the body is pushed backward into the bulk material to be loaded by backing up the truck chassis. The body tailgate, which is pivoted at the bottom, is automatically controlled by a separate drum and cable so that it can be swung downward to act as a scoop,

The body may be entirely disconnected from the chasses in thirty seconds.

Motor-Truck Tanks Deliver Printer's Ink

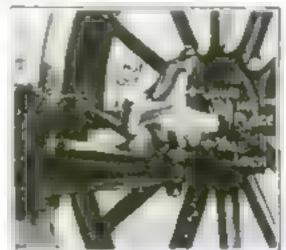
THE first truck to be employed in carrying ink in bulk is shown in the illustration below. It is used by a Hoboken, New Jersey, ink manufacturer to deliver ink to several of the New York city daily newspaper plants.

While the carrying of ink in a truck tank at first would seem comparatively simple, it presented two problems which had to be solved before the method was made practicable. The first of these was to prevent the ink from freezing in cold weather. This was solved by running the exhaust pipe from the truck engine through the bottom of the ink-tank.

The second problem was to get the ink from the truck tank to the storage tank usually placed on the roof of the printing-plant. When the ink was delivered in barrels these were raised to the roof in the freight elevator. But with the ink delivered in bulk in 750gallon lots, the use of barrels for unloading was impracticable. A new method had to be devised, and so a filler pipe was run from the roof tank to the sidewa!k

The ink is allowed to run into this pipe by gravity and is then lifted to the storage tank by a pump in the basement of the printing-plant

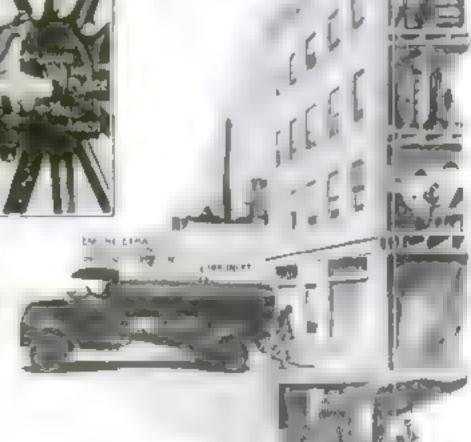
ROOF STORAGE AN





4, 5 ... * When this lock is snapped on the wheel, the cur can be run only in a

straight line One advantage of the lock is that it conforms to all city ordinances in that its use does not make the car immovable, which would constitute a danger in cities in case of fire, but permits it to be moved in a straight line either forward or backward. The front wheels, however, cannot be turned so long as the lock remains in place.



Printer s rok is delivered in bulk by this tank truck The ink is discharged by gravity and pumped from cellar to roof

In an Emergency This ls a "Hot One"

IF, while using your automobile on a very cold night, you discovered that, during a short stop which you were obliged to make, your radiator had become "frose up," what could you do to thaw it out so that you could safely run the engine and get home?

This was the problem which the writer encountered recently, and its solution again proves that recently is the mother of invention

After considering a number of impracticable and more or less wild possibilities, the logical conclusion was that the engine must furnish the heat wanted. This is the less of the "big idea" of driving the cooling fan in a reverse direction and thus

making it a heating fan. The idea was quickly carried out by first alacking the fanbelt and then crossing it to give a reverse drive to the fan.

In less than ten minutes the radiator was thewed and water circulation resumed; the belt was then replaced in its normal position and "Home, James," was again possible.



By reversing the fan the warm air from the engine is blown against the radiator. Thewing it out



If you live in an apartment on wheels, moving loses sta terror and becomes a pleasant diversion, a morrey of delight at all times

Traveling with a Furnished Apartment

How a suite of rooms in a reals, so that, if you ashes, to take a real of take are to take a real of take are to take a real of take are to take a real of the take are to take a real of the take are to take are to take a real of the take and the take are to take a take are to take a t

On the motor-trues he has had constructed a being four which a so
does daty as a distar room. The
rater carmes he seem groom and
buttroom Between the ing-room
is essent of his true to g apartment he has a passage tax, so mewhat
a ter the design of his true to a partment he has a passage tax, so mewhat
a ter the design of his more car telesoring residences has an equite
possible for a arge intertrues to low
two or more trailers, each carrying
one room, connected by flexible
vestibules.

A New Logging-Truck Loads Itself and Trailer

A LOADING mechanism has recently been placed on the market which may be applied to any make of motor-truck. The apparatus is

particularly adapted to loading big logs on motor-trucks or trailers. Furthermore, the same mechanism may be used to pull the logs from the place where they are cut to length to the side of the truck or trailer on which they are to be loaded

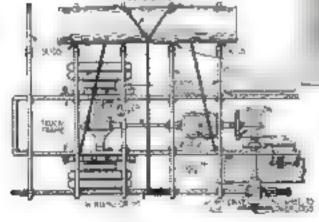
The entire apparatus is operated by the truck-driver simply throwing in a

clutch and pressing down a pedal, the power being secured from the ordinary propelling engine of the motor-truck on which the apparatus is mounted.

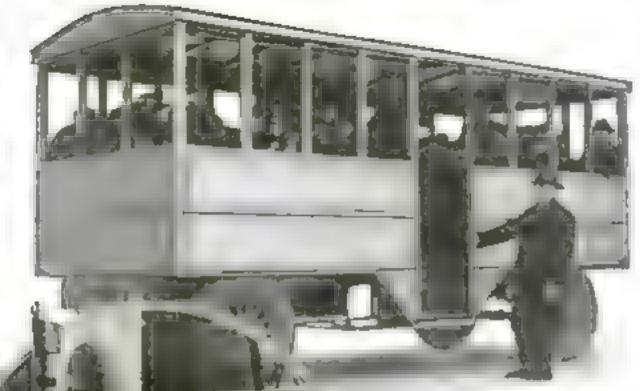
Logs of any size can be loaded on the truck or its traders by utilizing the power of the driving engine of the motor truck. The diagram on the left shows the detail of the arrangement of the mechanism which is controlled by the driver. The logs are bauled by a chain which is wound on a drum. The size or the shape of the logs do not affect the work of the machine. Logs may be loaded from either side of the truck. In addition, other unwieldy

objects required at a lumbercamp can be handled equally well.

The apparatus consists of a framework for supporting the logs, a winding-drum and a mechanism for turning the drum by means of power taken from the truck engine. The supporting framework takes the place of the ordinary truck body and consists of four I-beam sills set equally distant crosswise of the truck frame at the back of the driver's seat. The winding-drum is mounted on a shaft carried at the ends of the cross sills and parallel to the centerline of the truck chassis. The power is transmitted from a driving friction disk on the shaft to a driven disk at right angles to it.



New and Practical Accessories for the Passenger Automobile and the Truck



This hibricator, which is made in the shape of a tomahawk, can be forced between the leaves of the automobile spring by a few tapa with the hammer. It feeds the grease from a bottow handle

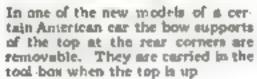
Bus trailers help to solve the passenger-transportation problem The bus shown here has reversible and rattan covered scate for thurty persons, and is arranged ministerly to a street car with doors at the side



By paying an annual fee to the electric light company of London, Ontano, you obtain the right to tap the electric current at any of the pluga installed at numerous points, for heating your radiator in cold weather



Nuts, bolts, or tools accidentally dropped into the drip-pan of thr engine are easily recovered without loss of time by means of a magnet attached to a wooden handle

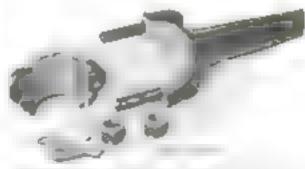




Carbon scrapers may be used to advantage for fastening or unfastening screws in places inaccessible to streight screwdrivers The scrapers are made of the best materials and will stand hard wear



With this extension wrench handle, nuts in places reached with difficulty may be turned with any flat or S wrench without resorting to a makeshift

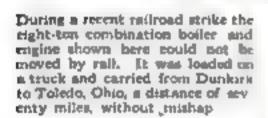


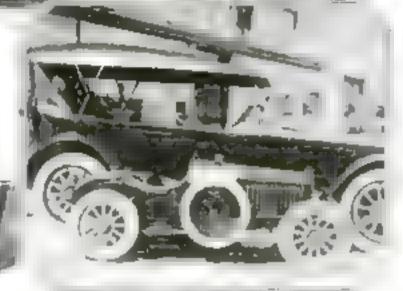
Babbitt faced shims for automotive bear ings are among the most recent ap provements. The shous are locked in the man ner shown to the brass part of the shung



Instead of crawling under your car to oil the springs, take a spray gun filled with kerosene and a httle powdered graphite and spray the mixture between the leaves. The kerosene will carry the lubricant

What Inventors Are Doing to Improve Engine-Driven Road Vehicles of All Kinds





What is believed to be the smallest highpower automobile ever built is shown in the foreground of this picture. It has shown a speed of fifty-eight miles an hour, is a wonderful hill-climber, and is equipped with a two-speed transmission and a six and a half-gellon gen-tank



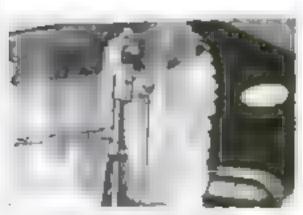
By pushing down the small thumb lever, the rubber wanter is pressed against the thread of the tire valve and air leakage prevented when the tire is being inflated



This machine will enable the operator to inspect an automobile tire in a few moments. A powerful electric light discloses any picked-up mails or small breaks or cuts in the tire



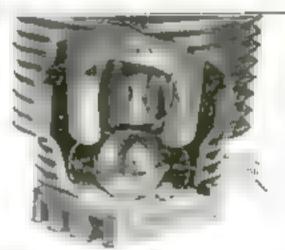
By turning the occuntric lathe of this at tachment with your finger you will look your bood so securely that it will not rattle. The tension spring in adjustable.



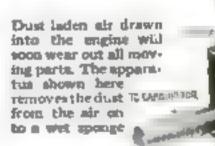
Desiring to give to his automobile a distinctive appearance, one owner of a sporting model cut the side windshields and ventilators of his car as shown here



This apparatus indicates the voltage of your storage battery on charge or discharge and the state of efficiency of any plate in the battery



In this self-cleaning and self-cooling spark plug a monel-metal bull, kept in constant motion by the vibration of the engain, prevents excessive curbon deposits





If you wish to keep the springs of your automobile well oiled, always place an old piece of felt soaked in oil between the springs and the guiding seat on top of the springs



This small automobile is not a toy for children but a racer capable of traveling at one hundred miles an hour

The Seven-Foot Automobile

"HE "Flying Peanut" is the nickname given to what is and to be the smallest practicable automobile. Seven feet long over all, it is hardly a foot and a half longer than the average man is talk. Yet it is so well proportioned that It would be difficult to distinguish it in a pleture from a fullfledged racing-car were it not for the comparison in size of the car and its driver. It is owned by Robert Breese, of Long laland, who is seen driving it in the accompanying illustration.

In its design the miniature machine follows up-to-date racing-car engineering, except that like the early racers, the power of the engine is transmitted to the rear wheels

by chains at the side instead of by a shaft. Otherwise the radiator, enginehood, springs, wheels, tires, and body are built in proportion. The wheels are small and give the car a low center of weight so that it is able to make sharp turns at a high speed. The engine is a modified airplane model, said to be able to propel the car at one hundred miles an hour

Because of the clever proportioning of its parts, the baby racer is most pleasing to the eye. The driver's seat is comfortable, and his eyes are protected by a miniature hinged windshield.

How Your Carburetors Waste Millions

DURING a series of tests under-taken for the purpose of ascertaining the volume of carbon monoxide discharged from the exhaust of running-trucks and pleasure automobiles under average working conditions, Dr. A. C. Fieldner, supervising chemist of the United States Bureau of Mines Experiment Station at Pittsburgh, found that 30 per cent of the gasoline now used by automobiles in the United States is wasted through improper adjustment of the earburetors, causing incomplete combustion Estimating the average price of gasohne at 34 centaa gallon, American automobilists waste annually more than \$231,200,000 for gasoline.

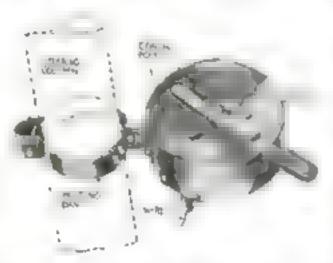
Regulating the Headlight Glare

WHILE most engineers have attacked the problem of chunnating automobile headlight glare by the use of some form of diffusing lens, Mr. A. A. Tirrill, of Pittsburgh, Pennsylvania, solved the problem by an automatic regulator of the current strength or intensity

The regulator consists of a rheostat mounted in a cylindrical casing directly beneath the steering-wheel. Its contact switch may be moved from one notch to another by the driver's little finger without removing his hand from the steering-wheel. The apparatus affords eight degrees of intensity between the standing light and the maximum penetrating driving-beam.

The installation of this regulator does not interfere with the lighting system of the average car. Clear lenses and polished reflectors are used with the lights so tilted that no part of the projected beam extends above the level of the

The cover of the casing housing the rhebstat is provided with a flexible stop, which in adjustable so that it can be set at the highest noglare position allowed by various local authorities. The flexible stop may also be lifted, permitting the rhecatat contact handle to be moved down to the standing dim position



The rheortax switch that graduates your lights from the steering wheel

A New Fuel-Feed System for Automobiles

DESIGNED to overcome the tem-peramental non-functioning periods of the vacuum systems fitted on most automobiles, the new system here shown uses the compression in the engine cylinders to feed the gasoline from the tank to the earburetor Whereas in the vacuum system the least fuel is supplied when the engine

requires the most, the new system supplies the most fuel under the same conditions. Because of its positive action, the new system does not permit of a condition of exhausted gasoline supply when climbing steep hills as long as there is gasoline in the main tank.

The fuel feeder consists of a small cylindrical tank placed under the engine-hood as shown in the picture. It can be mounted on any make or type of car, truck, tractor, airplane, or stalionary engine. are no complicated valve mechanisms to get out of

When the engine turns over, the compression in the engine cylinder to

which the feeder is attached is conducted through the piping at the left to a control valve inside the feedertank. It then passes down into a cylinder directly below the valve, foreing down a piston in that cylinder. This expels the mir below the piston through a spring-controlled valve in the bottom of the cylinder. As the

piston in the engine travels downward, the pressure on top of the piston in the feeder cylinder is relieved, and the epring beneath it forces it upward, enusing a suction below the piston which draws fuel from the storage-tank through the pipe at the right and top into the lower portion of the feeder-cylinder. As the engine piston again rises and puts pressure on top of the feeder-cylinder piston. the gasoline below it is forced into the feedertank, from which it flows into the carburetor by gravity. The piston in the pump continues to operate until the float rises and automatically closes the control valve.



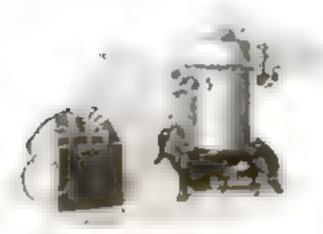
TO CARBURETOR

The harder the engine works the more fuel it requires and the more will be supplied to it by this new feeding

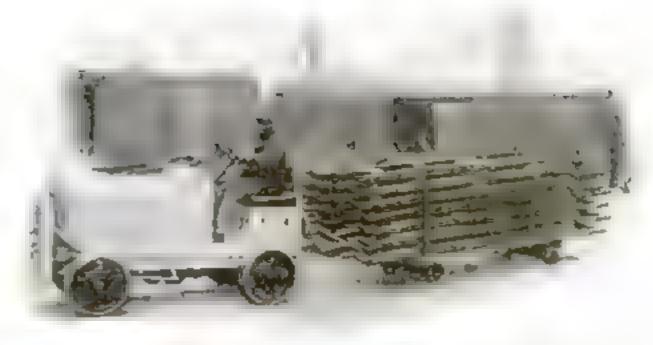
Opening Automobile Batteries Mechanically

THE putty-knife and the oldfashioned hot-water tank, when used to open the cells of an automobile storage battery, are expensive in time, money, and labor to the battery repairman and his customer. If only one cell needs to be opened, all have to be opened when the old hot-water-tank method is employed. But with the new battery steamer shown in the accompanying picture, one cell at a time or four cells together may be opened mechanically in much less time and at much less expense.

In smaller shops, where it would be a waste of fuel to keep the steamer hot all day, it may be put to a dual purpose in that the water ordinarily turned into steam for softening the battery seals may be passed through the upper of the two tanks shown and distilled for use in the battery after the cell-repair work has been completed. This combination steamer and still is heated on an ordinary gas-stove.



With this new steamer one or four cells of a storage battery can be opened



An industrial tractor that can push as well as pull load-carrying vehicles around plants, its pulling capacity being fifteen tons

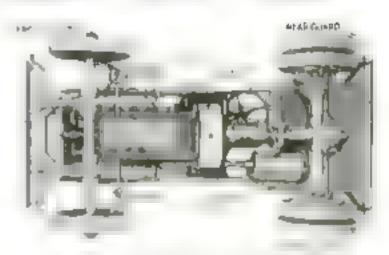
This Gasoline Tractor Pulls or Pushes

ABILITY to push as well as pull, and to run twenty-four hours a day if necessary, distinguishes this new industrial tractor from other forms.

The machine will tow or push standard trucks or load-carrying vehicles or skids about plants, and do the work more quickly and cheaply than it can be done by manual power.

It is a compact four-wheeled solid subber-tired vehicle with a power plant, clutch, gearest, and rear axle such as are used in a mail-capacity motor-trucks

Perhaps the most unusual feature of the vehicle's appearance is the two flat steel bumper plates front and rear to permit pushing from either end. The



It has the apparatus of a small motor-truck. Notice the front and rear bumper plates

machine's 22 5-horsepower gasoline engine will drive it at speeds up to fifteen miles an hour, and permit it to pull trailing loads of fifteen tons.

A New Double-Lift Hoist for Motor-Truck Bodies

ONE of the newest mechanical hoists differs from others of the same type in that the body is lifted in two distinct operations instead of

one. This method, while adding to the parts forming the hoist, serves better to distribute the lifting strains and makes it possible to raise the body to a greater angle.

The hoist is made to fit any make of truck from one to ten tons capacity. The one-ton hoist with a special frame extension is for Ford trucks and is operated by hand, while all the other sizes are mechanically operated by power from the regular engine.

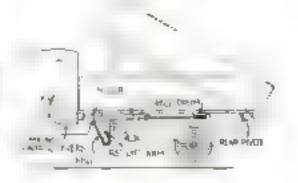
The first lifting operation is by means of two vertical lifting arms holted to the under side of the truck body near the front. These arms are raised by two wire cables wound around two drums at the rear end of the body.

After the latter has been raised for one third of its height, the bottoms of the two lift arms come level with the top of the truck frame and leave the wire

By lifting the truck body in two distinct operations this new mechanical boost secures a greater dumping angle

cables. The second lifting operation begins at this point, when two pivoted side arms, with rollers at their lower extremities, take the load on rails

along the tops of the body sills and force the body up to its full height. When lifted to its highest point, the body is held until lowered by an automatic power cut-out, which disengages the driving clutches working the two cable drums. The body can be stopped at any desired point between the lowest and highest points by a clutch and hand-brake lever.



Where Water Takes the Place of Dynamite

A JATER is not an ex-V plosive in the usual sense of the term. Any gas or liquid will explode if it is cramped into a small space under high pressure. Compressed-gir tanks often explode when the pressure reaches a high point. Water is made to "explode" by placing it under a pressure of several thousand pounds to the square inch.

There has always been a need of a way to tear apart stone masses without using blasting-powder and dynamite. "Why not use water under high pressure?" some one asked. The idea was put to test and found practical.

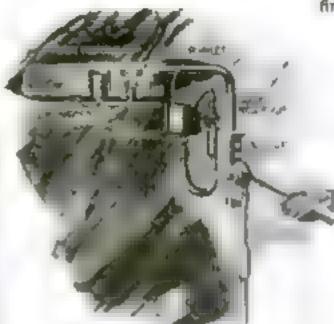
This method can be used for rezing buildings, quarrying, eoal-mining, potash-mining, tunneling, etc. No noise is produced and there is absolutely no danger of accident or fire. The hazard of having large quantities of high explosives on hand disappears.

The "exploding" machine is really a small but powerful pump that is used in conjunction with a compressedair drill. A hole is drilled to



Water taking the place of dynamite m razing a brick foundation with a battery of small hydraulic pumpe

The "exploding" machine is a powerful pump used conjunction with a compressed air drill. The punip, operated by band, forces the water into cynoders, bringing a tremendous pressure to bear and resulting in an explosion like that of dynamite



accommodate the expanding member of the exploding device. This part of the machine consists of a steel housing provided with a number of cylinders and pistons. Water is forced into these cylinders with a small hand-operated waterpump. After the waterpump is operated for a few minutes the pistons exert a tremendous pressure upward and downward. The material in which the device is inserted is fractured. finally it gives way to the

pressure.

One man is able to exert a terrific pressure with this simple device. A pressure of many tons per square inch can be brought to bear if the small water-pump is operated long enough. A battery of these machines will make short work of a brick building if it is to be torn down One illustration shows men at work "forcing" down a beavy brick wall

A New Collarless Harness for the Horse

WHAT is claimed to be the most revolutionary step in the advancement of horse haulage, since the first horse was harnessed to a wagon centuries ago, is a collectess harness tried out on the veldte of South Africa and now being introduced in the United States. The harness is the invention of J. C. E. Kohler, a rancher of the Orange Free State, in South Africa, and is revolutionary in that

It brings into play an entirely new group of muscles never before used by a horse in drawing a loaded wagon, the pull being made from the

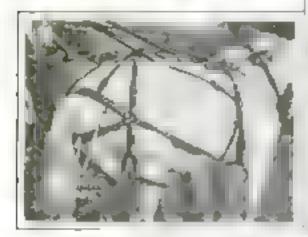
widest part of the horse's girth instead of from the neck.

It is the claim of the inventor that the use of the neck muscles and those of the fore legs for pulling interferes with the locomotion of the horse itself: and he points out that pulling from a heavy collar results in an urritated neck

The new harness is lighter than the conventional deagn; it is also cheaper. It may be employed for a one-horse wagon or for a double team by the addition of two extra shaft straps for a one-horse rig. For a double set, the only change necessary is a slight shortoning of the center shaft-pole. strap around the horse's greatest girth from which the pulling in done is connected with a pad between the two front legs at the top and held by a light strap around the neck where the collar is otherwise placed.

The new harness fits tightly around the hind legs at the rumps and thus makes back-





A rancher of South Africa claims that the horse has been harnessed inefficiently ever since the first member of the species was subsidued by man



This rancher J C E Kohler, has invented a new kind of harness, which brings into play the correct muscles for drawing a load, the pull being made from the widest part of the horse's girth instead of from the neck



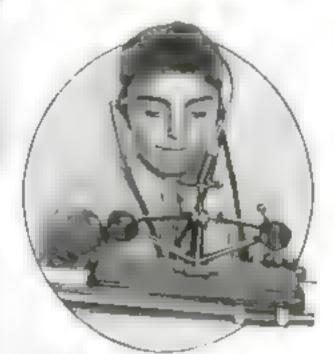
The new harness is coloriess, and the horse is spared painful sores that the collar often causes. It is also lighter and cheaper

thread

A Talking Machine that Uses
Thread for Records

By P. Schwarzbach

Photography & American Photo Service



Here is a less complicated thread recording machine for children. After the speaking or listening apparatus is attached, the thread is set in motion

"LA This request may sound strange to you now, but it is quite possible that before long you may be saying those very words yourself. For Mr. E. Steiger, a Swiss, has invented a sound-recording instrument in which thread is used for the records, instead of hard rubber. Imagine a thousand yards of

When he speaks into the horn, a dia-

phragm at the other end vibrates and a

stylus makes impressions on a moving

rubber. Imagine a thousand yards of opera thread! It would perhaps fill one small spool; yet when played on the reproducer would deliver much more music than the largest hard-

rubber record made today.

The thread is ordinal

The thread is ordinary thread treated with a coat of a specially prepared composition that is very sensitive to sound when it becomes bard. It is not affected by temperature, nor does it require any special cars. Thus it is both inexpensive and durable.

The blank thread is stretched over pulleys in the recording machine. There are two main pulleys that hold the thread directly underneath the recording stylus, and there are auxiliary pulleys that help keep it taut. When a record is being made, the thread is moved forward at a uniform speed while the record-maker sings, talks, or plays into a horn. There is a disphragm at the other end of the horn and a stylus attached to it. Each sound-wave is recorded on the thread by this stylus.

One picture shows a man dictating in one of these machines. He holds the horn in one hand and a handle in the other. He turns this handle slowly and evenly as he speaks into the horn, and it sends the thread on its way



He's listening to the tale of a thread. Since the thread is very theap and much more durable than the usual hard-rubber records, we may soon expect to find it in all fields of talking machinery.

by further pulley action. It is so small that you can carry it on hustness trips. After dictating a number of letters, you cut off the used thread and send it is an envelope to the office, where it is run through a machine which has a receiving set attached to it. The operator listening to the spoken words transcribes them on a typewriter.

There is still another important use for the thread machine—in the home. Suppose some member of the family is far away. The letters that you send each other are practically the only means of communication you have. Would it not be more comforting to hear each other's voice? A few yards of talking thread would make it possible.

Most of the machines are operated by hand. There are some machines,

however, in which this is done me-

chanically, insuring an absolutely uniform movement of the thread.

Push the Bed into the Wall and Forget It

THE new drawer bed in an invention introduced by J. G. Stickley, of New York. A comfortable bed of normal size is so arranged that it disappears into the wall when not in use.

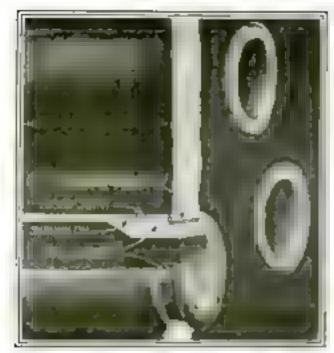
The bed operates on ball bearings on a track built under the dressing-table in the adjoining dressing-room. In the morning the bed-clothes may or may not be removed, as desired, but the springs and mattress are left on the bed. The mechanism is unlocked by a simple operation that involves no lifting; then a



In the present-day apartment-house a bed that takes up no more room than the paper on the wall is a boon indeed

slight shove causes the bed to alide easily through the wall into its place under the dressing-table. The footboard of the bed becomes the finished base of a bookcase that is built into the wall. The footboard fits exactly under the bookcase and makes a complete piece of furniture, giving no inkling that it is part of a bed.

Now step into the small dressing-room and see what has become of the bed. Open the doors under the dressing-table. There it is, mattress and springs, with the spread and pillows.



To prevent leaks in boller-tubes. The tube end has a square shoulder that rests tightly against the plate, with a copper gasket pressed between

Leaky Boiler-Tubes Will Weaken the Locomotive

A LOCOMOTIVE can be no more efficient than its boiler-tubes. When they are leaky the locomotive loses its power rapidly, and it must either be repaired at considerable expense and loss of time, or run with low efficiency. When a locomotive stands idle in the repair-shop, the railroad it works for is minus just that much of its equipment and whatever it is capable of earning in hauling freight

or passengers. Until recently, preventing boilertubes from leaking has been a vexing problem. A thousand and one different methods have been proposed and tried without satisfactory results. It is only recently that a practical, leakproof joint has been devised. This new method of inserting tubes in boilers, which is the invention of Charles S. Coleman, of Los Angeles, California, is illustrated herewith. The tube end has a square shoulder that rests tightly against the plate, with a copper gasket pressed between. A slight bevel is given to the hole into which the tube end fits, and this "wedge effect" also helps to prevent leakage when the locomotive is in The boiler-tube proper is shrunk on the tube end and the joint fused.

This method is a great improvement over the old expansion method, which was really only half a remedy. A tube forced into place by the old expansion method is shown.

The new method of holding boilertubes in place has been found ninety per cent efficient and results in a saving of from ten to twenty per cent of the fuel consumption. This also means from ten to twenty per cent more mileage obtained from each tenderload of coal. The saving of fuel results from maintaining the boiler pressure at normal.

An Automatic Chemist

ONE more machine to replace human labor! This time the services of an analytical chemist are dispensed with. Philip E. Edelman, an electrical engineer of New York city, has devised an apparatus that will stand watch over a chemical process and act more efficiently than a well-trained chemist.

In large chemical plants it is the duty of a routine chemist to watch certain processes. He must do this through analysis. At certain periods of the day or night he takes samples of the "mix" to determine whether or not the proper quantity of the various ingredients is present.

In paper-milia, the sulphurous acid used in the bisulphite process must

be held to a free sulphurdioxide content of two percent. It is the duty of the chemist to see that this percentage is held. The automatic chemist will automatically regulate the ingredients.

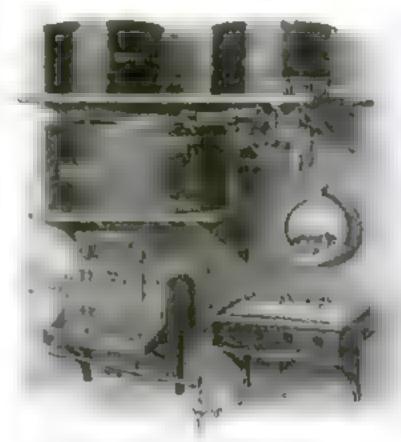
How does it work? Every chemical mixture has a certain electrical resistance, or, we might say, it has a certain degree of electrical conductivity. This degree of conductivity depends entirely upon the percentages of the various chemicals present. Some mixtures have high conductivity, while others offer great resistance to the passage of an electrical current.

Since alight changes in mixture vary the electrical conductivity, an especially designed electrical controller is made to follow closely such chringes automatically and to keep the ingredients of the liquor at certain values. This is done through an automatic valve, electrically operated.

Any change in the acid content will change the resistance of the solution or liquor. A relay closes a motor circuit, which operates an electric motor connected with a valve. The valve opens and allows acid to flow in.

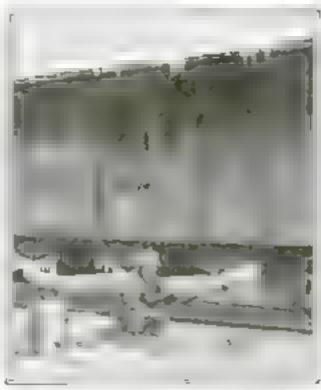
When the conductivity of the solution is brought back to normal through the addition of acid, the valve is automatically closed.

Such an apparatus as this of Philip E. Edelman will do much to overcome errors of judgment by the chemists.



This arrangement of apparatus will perform all the duties of a routine chemist

It Thaws Out "Empties"



Thewing out a frozen "empty" with a huge gasoline blow turch, thereby saving time and money

WHEN empty coal-cars are returned to the mines in the wintertime, the hoppers on the bottoms are
often frozen up. In stubborn cases,
several men must work half a day or
more to pick the ice away. One man
can do the trick in a few minutes if he
is provided with this large gasohne
torch. A separate tank contains the
fuel, which is fed to the burner through
a rubber hose. The burner is mounted
at the end of a long pips that also
serves as a handle. A valve at the end
of the pipe allows the workman to
adjust the flame.

When a frozen "empty" is received at the mine, the workman directs the big, hot flame of this torch against the parts giving trouble. Things start to crack and sizzle and in a few moments the mechanism is loosened up and the car is again ready for business over the shining steel tracks.

Is the Ouija-Board Controlled Subconsciously?

This Hindu scientist's invention may tell

By Herbert Asbury

THERE has always been a great deal of controversy about the oui,a-board. Its most sealous supporters contend that the messages which are spelled out by the little triangular table are in reality com-

munications from the dead, while the skeptics have held all along that if the operator does not knowingly manipulate the board, he at least does so subconsciously

Sunker Abaji Bisey, a Hindu scientist, has invented a new sort of oulja-board by which he believes it will be possible to settle absolutely and without doubt the question of conscious or subconectous operation and manipulation. It is not possible for an operator to control the Basey ouijaboard, which he has called the "spirit typewriter." It is constructed of steel, and writes only when the triangular table is operated upon a steel tray, which is fitted with blind keys connected with an invisible ribbon, such as is in common use on all typewriters. The operator does not see what he

is writing until he has finished, and then the paper which has recorded the progress of the table is taken from its hiding-place and he sees the message.

The triangular table is nothing more than a piece of steal fitted with three casters or rollers, as ordinary outpaboards are, the tray on which it moves being the mechanical part of the invention. This tray is fitted all around its circumference with a series of pega, between each two of which is a typewriter key. The keys correspond to the letters and numerals found on an

Sunker Ahan Bisey operating his "optrit typewriter," fitted with blind keys connected with an invisible ribbon

ordinary out a-board. As the triangular table under the hand of the operator travels about the steel tray under whatever influence it is that actuates a out a-board, one or another of its three angles, instead of touching the letters, as is done on the wooden and visible board, pokes its point between the pegs and strikes a key. Each key is connected by a lever to a letter or numeral beneath the tray, and a touch between the pegs impresses that key or numeral upon a type-writer ribbon, which is also hidden. At

the end of the sitting there is withdrawn from the machine a paper on which is noted every letter or numeral struck by the triangular table. The ribbon moves one space after each

printing of a letter.

The tray upon which the ouija moves is round, and all of the pegs and posts upon its surface are perfectly plain faced and exactly similar to one another in appearance. Set an operator before the board, turn it about several times, and it can easily be seen that the board cannot be knowingly manipulated.

The following description of the invention as furnished by Mr. Bissy to the Patent Office may more clearly explain the mechanism in connection with the drawing.

"A circular tray is mounted on a suitable frame, and its surrounding edge is divided into thirty-six equal parts by pegs. The space left between the pegs is occupied by the button of the key lever. There are thirty-six such keys—one for each letter of the alphabet and

ten numerals. The operating board is made triangular and any of its corners is designed to enter the gaps between the pegs. A circular board is pivoted on the triangular board and serves as a hand rest. A paper ribbon and ink ribbon are mounted on rollers and placed underneath the tray. No letters or signs appear on the key buttons to prepare the mind of the operator, who can operate the apparatus placed before him in any position."

Mr. Bisey's invention is an ingenious version of the overworked only a.

Traffic Does Not Wait on This Track-Welder

ELECTRIC welding has reached a point of development where its application is growing daily. All of the rails on electrical railway systems are held together not only with bolts and fish plates, but with a permanent weld that is an added security against accident and deterioration. The weld eliminates the possibility of the rail joints becoming loose.

Here is a new electrical welder in use. This particular type is a very recent development, all superfluous parts having been eliminated. It is mounted upon three



When a street-car comes along, the men roll the small dynamotor off the track and allow it to pass. This requires but a few minutes

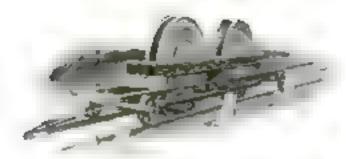
wheels so that it may be rolled along the track and easily moved from place to place.

The dynamotor takes the current from the system when it is connected to the rail and trolley wire. It converts this current into one suitable for welding purposes.

A man is shown hooking one wire over the trolley with a long pole.

The man at the left of the picture is adjusting a carbon mold to a rail joint in preparation for the welder, who is seen working at the right of the picture.

Testing a Road Before It Is Built



The testing wheels run in tracks beside the road slabs. One pair of wheels having a spring attachment weighanine thousand pounds; the other unspring wheels weigh three thousand pounds. When dropped on the road below, they have the same effect as a seven- or eight-ton truck

BANG! You drive over a hole in the road, get shaken up, break a spring on your car, and say things about state roads. The road materials are usually at fault; they should have been thoroughly tested before they were put down.

That's what the government is doing to-day—testing forty-nine different kinds of road composition by heavy-weight methods. The various mixtures are made up into slabs seven feet square, of different thicknesses.

All sorts of concrete mixtures, different kinds of bricks on concrete bases, and and cement—all are given their

chance to prove their merit

The slabs are laid end to end, and over thom an impact machine is drawn by cable. The machine travels in tracks at the sides of the mabs, and carries in its arms two pairs of beavy wheels, one pair having a spring attachment and solid rubber tires. The wheels are dropped on the various slabs, and they have the same effect on the road material as the rear wheels of a seven-and-a-half-ton truck. The unsprung wheels those having no aprings to help absorb shock—weigh three thousand pounds and the sprung ones nine thousand pounds. watching the surface of the various slabs after the weights have been dropped on them several times, it is easy to determine which mixtures will stand up best under traffic conditions.

There is another test that is used the pile-driver test. But in this case there is no pile for the weights to fall on; they fall directly on the slab. The lower weight, weighing one ton, is long, thin, and has no spring to absorb the shock when it drops. There is, however, a hard rubber aboe at the bottom. On top it carries a full-sized truck spring which receives a second heavier weight that is dropped from This three-ton weight is cushioned just as a load on a truck is cushioned. Both weights are raised by a cam that is operated by a gasoline engine. As the cam turns over, it drops the load, and the combined weights have the same effect on the



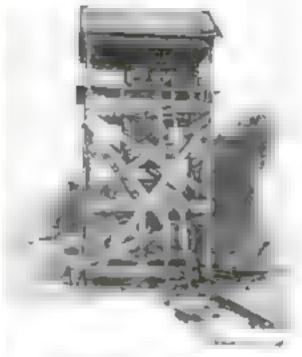
Road materials are now given beavyweight tests by the government. Here are forty nine sections of different road compositions. Heavy wheels are dropped on each section and their comparative resistances determined.

road as the rear wheels of a truck passing over an obstacle.

The weights can be dropped from different elevations up to a maximum of four inches. When dropped three and a half inches, the impact pressure equals sixty thousand pounds.

The amount of weight to be dropped can also be varied. In this way it is a simple matter to duplicate virtually all the shocks on an average road

The pictures on this page show the



The road materials also receive a piledriving test. The pile-driver has a oneton weight with a rubber shoe at the bottom and a truck apring attached to the top. A second weight, of three tons, is also used in the test

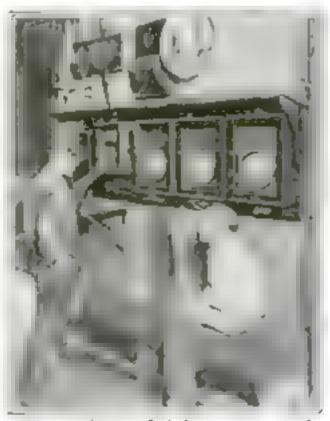
two methods of road-testing described here. The pile-driving tester was photographed when the three-ton weight was being raised. You can clearly see the rope and pulley used for the purpose.

The slabs that it pounds are placed closs together, but they do not touch each other. They may be seen at the right in the photograph showing the heavy wheel tester

in action.

To Prevent Heat Waste in Furnaces

YOU pay so dearly for coal these days that none of the heat it gives off should be wasted. Watch the tem-



When wishing to find the temperature of gas in the flues, he turns a switch and is answered in five seconds

perature in the smokestack closely and you will be able to tell whether your furnace is delivering your money's worth in heat. But how can you watch this temperature? By means of a pyrometer—a kind of thermometer that records high temperatures.

The sensitive element of a pyrometer consists of a thermocouple, which is made up of two wires of dissimilar metals that are attached to a delicate current-recorder. When the couple is heated, a current will be produced and the pointer on the recorder will register the amount, which increases with the temperature.

To find the temperature in the smokestack, place the couple in the stack. The current generated is translated into degrees of temperature and is constantly recorded on a scale situated in a near-by room or in a destant superintendant's office. The measage of the furnace is electrically conducted. If the temperature is too high, something is wrong with the system. In connection with the temperature scale, there is a continuous recorder very much have a recording barometer.

Learn How to Refinish Your Automobile

Save sixty dollars by doing it yourself

has the impression that an old automobile cannot be properly refinished outside of an automobile paint shop. Nothing can be farther from the truth if this work is taken up in a systematic, workmanlike, and thorough manner. It is possible that the amateur, provided with proper instructions and a working knowledge of the steps to be taken, can paint his car for twelve or fifteen dollars when the same job would cost him fifty or seventy-five

THE public in general

dollars if done in a commercial garage. It is possible for the automobile owner to finish his car this winter, providing he has some spare time and a quiet place to work. Painting an automobile takes considerable time, because each coat applied requires a certain amount of time to dry, and this perhaps is inconvenient to some. It is no worse, however, to have your automobile laid up in your own garage where it can be worked on from day to day, than it is to have it in a public garage or paintabop for a week or ten days. The main factor resulting in failure is careleasness. The automobile owner equipped with the proper tools, materials, and some spare time, if he is careful, need not fear the outcome.

A great many attempts at automoblie painting fall because of the lack of proper materials. For instance, when oil is used as a thinner in place of turpentine, the cost does not harden as it should and does not stand the rubbing and smoothing processes. Also, when cheaper house colors are used in place of colors ground in turpentine, a greasy amear results which does not dry in the right manner. At the outset, then, one should determine to use the best materials available.

A list of the materials required: Metal primer, obtained from any wellknown varnish manufacturer.

Rough stuff: this is usually procured in cans at twenty-five or thirty cents a pound and is a sort of a heavy paste. It is to be thinned with turpentine to n thick working consistency and is then ready to be brushed on.

Some of the Materials Required

Other materials required are white lead, dry white lead, dry bolted whiting, turpentine, coach japan, and raw linseed oil. After the painting of the automobile is finished, a good quality of varnish is required to cover the body and retain its gloss. Directions may be had from any paint manufacturer.

It will be well to have four or five brushes on hand. A large flat brush 3 in. or so in width will be required to put on the rough stuff, primer, and lead coats. A 2-in, brush of better quality should also be on hand to apply the color coats. A little extra expense in procuring a good brush will be well worth while. For it is escential to have the color laid on in

smooth, even costs. A large, thick brush is the best for putting on the varnish. It is necessary to put the varnish on as rapidly as possible, and for this reason a large, first-quality brush will be the best. All brushes work better after having been used for a time and if new brushes are purchased, they may be broken in by saturation with oil and using them briskly on a board for fifteen or twenty minutes. As they are used they become more phable. A good way to keep the bristles from bending and becoming deformed is to bore a small hole in the base of the hundle at a suitable height and after preparing a small can of linseed oil, run a wire through the hole, resting it upon the edge of the can, thus supporting it in a perpendicular position.

For the rubbing material, anndpaper, emery-cloth, or steel wool have their advantages and disadvantages. Steel



After the old point has been removed, fill all dents and cracks with putty

wool or emery will perhaps be the most effective and but a small quantity will be required. The grade should be fine or very fine. Pumice-stone is preferred by some, but is more expensive and the steel wool and emery-cloth will serve nicely.

Aside from the tools mentioned above, a few vessels, a chamois-akin, a large brush, and some cotton rags will also be required.

It should be understood at the outset that the automobile must be free from dust and drafts when it is being

The first thing will be to thoroughly wash the automobile. This may be done outside, and plenty of water should be at hand. Go over the body and chassis and soften all chunks of mud and hardened dust. After the dust has been removed, mix some kerosene and turpenting together in equal proportions and with this solution thoroughly soak all oil and grease spots that were immune to the water. This solution loosens any remaining spots and they can then be rubbed off.

Carefully go over the entire automobile, look-

ing for checks, cracks, portions of the body where the paint has chipped off, and then decide whether or not it will be necessary to remove the old paint. Providing the body is reasonably free from these blemishes, a lot of time and work may be saved by leaving the original color on. If there are but few spots where the paint has chipped off, or only an occasional crack or check, it will hardly be wise to remove the paint. Should there be many of these defects, however, the only safe and same method will be to take off the paint.

Assuming that the automobile is in a condition to warrant a complete job of finishing, secure a liquid paint and varnish remover, or a gasoline blowtorch. The liquid remover comes in cans and is accompanied by thorough and accurate directions for use. This liquid thoroughly softens the old paint in a short time so that it may be scraped off easily with a putty-knife or other dull-bladed instrument. The entire surface in then washed with turpentine, removing the last vestige of the old surface.

How to Use the Blow-Torch

If the blow-torch is to be used, hold it in your left hand, and with a puttyknife in your right, go to work. Hold the flame 3 or 4 in, from the surface and go slowly back and forth over a email area until the paint is thoroughly blustered. Follow immediately with the knife, scraping off the scales as fast as they are loosened. When one small patch has been treated, select another, and repeat operations. The blowtorch method is not as satisfactory as the other, for on almost every occasion now and then a spot will not come off with the application of the heat, and is, instead, burned on to the metal. It is then necessary to use candpaper or varnush remover.

After the automobile has been freed of all paint and cleaned with the keroseneturpentine solution, carefully go over all sheet metal and take note of any dents, cracks, or depressions which may be there. These are then filled in with solder or putty and smoothed off with emery-cloth. Solder is better than putty, for it is permanent and stands more hard use than putty, but putty is more easily applied.

After the body has been thoroughly cleaned, it should be gone over with a medium grade of sandpaper. This process roughens the surface of the metal slightly, and enables the first coat, or primer to adhere firmly. Too great emphasis cannot be laid upon this first coat. Any grease or foreign matter between the metal and the first coat will eventually result in a chipped-off place.

(To be continued)

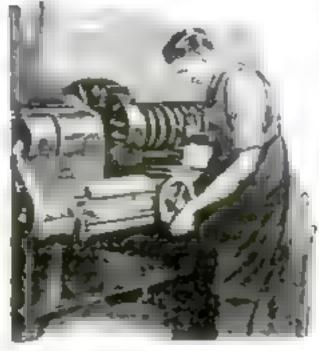
Repairing a Cast-Iron Roll Under Difficulties

By W. S. Standiford

I N every mechanic's life emergencies will arise that call for rapid thinking and original work on his part in order to keep the wheels of industry running smooth; y.

In this article the writer tells how he made an emergency repair on a broken roll that lasted until the roll was worn out. When a bar was going into No. 2 pass, a sliver on it jerked the tongs from the hands of the roller and it was jammed between the side of the bar and collar, separating grooves 2 and 3; the result being that an 8-in.-long section of collar was broken out. Owing to conditions, welding supplies were unobtainable; a new casting could not be had in less than three weeks, four days more being required for turning a new roll.

The writer was delegated to make a mechanical rapair if it were possible to make it withstand the side pressure exerted by the iron during rolling. A patch the size of the broken section and screwed to roll was first thought of, but rejected as impracticable as, both joints being near one another, the patch would spring and shear the bar. It was decided to cut the cast-iron collar off the roll altogether and re-



How a broken cast-from roll was replaced with one of wrought from

place it with a wrought-fron one, the joints of the halves being a long distance apart. To enable it to withstand side pressure, a slot having a slight taper and 2½ in, deep was cut into roll, the width being 2½ in. After the slot was turned, a bardwood templet was made. The length of the two balves was ascertained by the

"cut-and-try" method until, when placed in the roll grooves opposite one another, they made a snug fit at the joints and bottom. From these templets a wrought-iron collar was forged and turned with a taper matching the slot; the tapered section being a few thousandths of an inch larger so as to make a forced fit in the slot. Half of the wrought collar was forced in the slot as far as it would go by using hammers, a heavy iron ring was then put over the half collar, and 4 jacks, one opposite each joint, and others spaced equal distances apart.

Part of the ring in front of the jacks was filled with iron blocks. The jacks were then screwed up, care being taken to get equal pressure until the collar touched the slot bottom. The collar was drilled and tapped to take ½-in. screws that extended I in. into the roll body. The other half of the collar was next fitted, a good job resulting. The roll was put into the lathe and the collar turned to the same size as the others. When tried in the mill, the new collar stood the heavy pressure admirably, a slight mark on the from bars produced by the joints being removed in the finishing pass of

Brain Saves Brawn when Fixing the Ventilator

By Edward H. Cruseell

ONE day the boss took me up to the attic floor of an old-fashioned office-building to do some work on the skylight. This upper floor had originally not been intended for use and was only partly finished, the wooden roof trusses showing in all their nakedness. The main roof of the building was flat, but out of it projected, one at each end, two square towers about 50 ft, high, and the skylights were at the tops of these towers.

The top of each skylight was provided with a metal ventilator, and it developed that one of my fellow workmen, some days before, had been employed to fit the bottoms of the ventilators with hinged doors that could be closed by means of a cord from the floor below. Only a single cord was used and it was supposed that the doors would open of their own weight. As a matter of fact, it took so much cord to reach the floor, that the weight of it nearly balanced the door which, in consequence, would only open an inch or two. My job was to fasten lead weights on the doors to make them overbalance the cords.

With the height of the upper story added to that of the tower, the ventilators were all of 70 ft. from the floor, and as I looked up the inside of the tower I inquired of the boss, "How's a fellow going to get up there?"

"I don't know," was the reply, as he turned to leave. "Smith got up there



There are more ways than one to fix the ventilator in a skylight

all right; you ought to be able to do what he could."

Well, when a fellow came to notice the pieces of 2 in. by 4 in., spiked here and there up the sides of the tower, it wasn't hard to guess how Smith had climbed it. He had evidently taken a ladder, climbed to the top of it, spiked on a piece of 2 in. by 4 in., carried up a piece of plank, stretched it across the tower, then carried up another ladder, stood it on top of the plank and so on until he had reached the top.

I had no doubt of my ability to climb the inside of the tower in the way Smith had, but I had no intention of lugging half a dozen planks and ladders up to the top of a four-story building unless it was absolutely necessary.

the rolls.

Permanent ladders on the outsides of the towers made the tops of them (which were flat, and surrounded with an ornamental iron railing) easy of access and my first thought was, that I could go up the outside of the tower, take a couple of lights of glass out of the skylight, stretch a plank across and work from it. When I got to the top of the tower, however, I found that by taking out four screws I could lift the ventilator off the skylight and get at the top surface of the door quite easily. So I went below again, pulled each door shut, (astened the cords securely, carried up my weights, fastened them in place, and replaced the ventilators, screwing them down securely.

How to Bore a Conical Hole through Wood

WHEN you have a conical hole to bore, such as for a handle hole in a wooden maul or other similar place, leave the cutter of an expansive auger bit a trifle loose and begin boring at the side where the smaller end of the hole is wanted. The inner edge of the cutter lip being angular, the cutter will gradually draw itself out from the body of the bit, making the hole larger as the bit goes into the wood.

Save Your Rabbit-Skins—They Are Valuable

By Marcellus W. Meek

BREEDERS of rabbits, especially of Flemish Giants, Belgians, French Silver, Beveren, New Zealand, and other breeds of which the skins are used for making high priced imitation furs, like French seal, mole, beaver, cony, etc., will find it to their advantage to save and properly prepare the skins of their rabbits.

A brisk trade has arisen in rabbitskins of the breeds mentioned. Fur buyers all over the country now pay good prices for skins which were thought worthless a few years ago, as their quality and fur value were little known; most of the rabbit-fur skins being imported from Europe. One New York manufacturer who manufactures rabbit-skins into near-neal, mole, and beaver-cony, and other Imitations of high-priced furs, advertises for 10,000,000 American raised rabbit-akins, and will pay good prices for them. It pays to save your rabbitakina if you are raising fur rabbits.

The illustration shows how the rabbit should be bung in order to skin the animal properly. The rabbit should be killed by a sharp blow behind the ears, and the jugular vein opened with a sharp knife. Hang the animal up as shown in the illustration, and begin skinning by cutting around the hind legs at the first joint, and slitting the skin down to the tail inside the hind legs, shown by the dotted lines. Skin around the yent. The skin is then easily pulled off "cased"—inside out like a glove. When the forelegs are



The proper way of hanging the rabbit and some devices for stretching skins

reached, a little deft work with the akinning-knife will remove the akin nicely. Cut around the neck, as it is not necessary to skin the head. When removed, the skin must be stretched and dried.

Fur dealers prefer "cased" skins. Fur stretchers are easily made as shown in the drawing, either from thin boards or wire. The wire stretcher which has a loop in the top is very easily made from \$5-in.-gage wire, and is inexpensive. Rabbit-skins must be dried in a cool, dry place—never in the sun or where it is damp.

Free circulation of air is necessary.

After the rabbit-skins are dried, they should be sorted as to size and quality, and each lot tied up separately. Burlap or grain sacks are the best for shipping skins. A card should be placed inside the bundle with name and address of the shipper, and the outer tag should give the name of the house to which shipment is made, as well as the name and address of the sender. Be sure to write plainly in ink. The sacks should be sewed up instead of just tied. Don't use sacks full of holes, and don't use wires to tie up the skins, as these might cut the pelts. It is best to ship by express or parcel post.

Although winter skins are preferable, many buyers will take summer rabbit-skins, as the rabbit often has prime fur in summer and fall as well as winter. Rabbit-skins are graded into "prime" and "unprime" skins—the unprime skins showing black spots or spisshes on the back where the new hair is coming in. Both grades are sorted in four sizes—very large, large, medium, and small. The least valuable grades are used for felt hats, and are termed "hatters' fur;" these are bought by the pound. The better grades are bought by the piece.

Move the Automobile Tires Forward as They Wear

By Robert A. Chandler

If he will change tires around in the manner described below, a motorist can make them last far beyond the usual mileage. This is done by reducing the strain on the tires as they wear away so that the newest tire is placed at the point of greatest strain and the oldest one at the point where the strain is least.

It is evident, even to a casual observer, that the rear tires wear out more rapidly than those of the front wheels. This is due to the strein of driving through the rear wheels, letting in the clutch, applying the brakes, use of chains, skidding, and so on. Now comparing the right side of the car with the left, the tires on the right wheels will wear faster. The left wheels run along the smooth part of the road where the ridges and ruts are all beaten down by the traffic. But near the edge the road is rough, there are more ruts and small stones, and sometimes these wheels must leave the road altogether. There is more likelihood of meeting broken glass, metal. and other objects on this side. Then there is more weight on these wheels because the car is tipped more to that side on account of the crown of the road. Therefore it may be stated as a general principle that the rear tires



Changing the tires according to the system here explained will mean a saving

wear more than the front once and the right ones more than the left.

Starting with all new tires it will be evident that the right rear tire will show serious wear long before the left front tire has got over its newness. At this point the two should be exchanged. It is difficult to state just when this change should take place, possibly it is best left to the discretion of the driver If a "non-skid" is used, the change should be made before the tread is worn so smooth as to lose its protective feature. At the same time the other

two tires should be exchanged to keep matters even

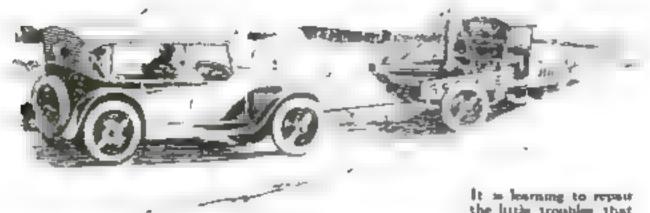
After a few thousand miles more we enter the second phase. One by one the tires will wear out and not even vulcanizing can save them. They must then be moved up in the sequence shown. Supposing the left front tire is discarded, the right front tire takes its place; the left rear tire moves forward and the right rear tire takes its place. The spare tire is placed on the right rear wheel, the point of greatest strain.

Of course if some tire is to be removed temporarily for repairs, it will be replaced by the spare tire instead of moving the rest forward, and as soon as returned it is put back in its regular position.

By following the a bove system you will not only make your tires last longer, but you will have less trouble from punctures—another good reason for following this practice.

The logic of the advice given by the author is unimpeachable and is based upon a careful study of the subject. Tests, extending over a period of several years, have proved beyond reasonable doubt that the rotation method suggested will actually result in a considerable saving of time, labor, and money to the owner of the car.

Don't Let the Tow-Car Get You



It is learning to repair the little troubles that keeps your car from being towed

DON'T condemn a spark-plug unless it is at fault. To determine thus, first find out which cylinder is missing explosions. Short-circuit each spark-plug with a screwdriver. If the engine slows down, it is a live plug. If it doesn't, that cylinder is not firing.

Disconnect the wire from the sparkplug and run the engine. If a good spark jumps from the terminal when laid upon the cylinder head, the trouble is in the plug or in the cylinder. If there is no spark, the trouble is in some other part of the ignition system. If a good live spark is shown, remove the plug and lay it upon its side on the cylinder head with its terminal attached. If it shows no spark, the trouble is in that plug.

Clean off the earbon with a cloth dipped in kerosene or use a brush. Touch up the points of the plug with emery-cloth, but do not scrape the emery on the porcelain, as that scratches it and makes it coot up all the more readily. A cracked core must be replaced.

Put the parts together and adjust the gap to approximately the thickness of a very thin dime. Try it again in the cylinder. If the engine missires, the trouble may be a loss of compression or faulty carburation.

Be sure to carry an extra set of lampbulbs, so that one can be replaced as soon as it burns out. You should know the candlepower of the bulbs in your headlights, side lights, tail light, instrument light, and dome light. Take them out now and make a memorandum in the box with the bulbs, and so insure your lighting future.

How long is it since you went over the connections of the steering mechanism to see that they were fastened securely? This should be done at least once a week, as more damage can be done by fathere of the steering mechanism than by any other cause. See that lock-nuts, lock-washers, and aplit-pins are doing their duty. Try each nut with a wrench even when it is secured by the means mentioned.

There is more wear on the aide walks of the right tire, due to the increasing use of the left-side drive. Some drivers have learned to drive up close to the curb without touching it. A

little practice on your part will go a long way in making your tires last their guaranteed mileage,

Now is a good time to go over the rim to see that the various parts have not rusted together. Give them a fresh coat of paint before replacing them. If this is not done, the mins will rust them together so that a demountable rim will become a permanent fixture on the wheel

The skilled driver rarely uses his brakes except for an emergency stop, or when going downhill. Learn to judge the distance and let your car coast to the point at which you wish to stop. This will save the brake linings and other parts, so that they will not have to be replaced so often.

The funnel used to fill the oil reservoir should have a strainer in it of very fine wire. It keeps out dirt and foreign matter which would otherwise fall into the system and clog up some small opening. One little piece of dirt might do no harm, but others would accumulate there and finally cause clogging. This matter of straining the oil is aspecially necessary with the type of lubricator using several small pumps, as a small piece of dirt getting into any one of the valves puts that pump out of commission immediately.

Some relief valves have handles set the wrong way, so that the valves shake open. If one becomes troublesome, replace it with another which is set properly. If this is not desired, the hole may be plugged with a piece of brass rod and a new hole drilled at right angles to the old one.

One of the many mutakes which beginners frequently commit is to rest the feet on the clutch and brake pedala. It wears out the clutch collar and makes it noisy, and this habit may also cause the brake to drag The best position is to have the feet near the pedals ready for instant use. but not on them. Sometimes the water does not circulate properly through the water jacket on the carburetor Run the engine and see if it warms up. If not, disconnect the lower pipe and see if the water runs through the Locate the stoppage and remove it. Remember that gasoline cannot evaporate unless heat is provided either by the water jacket or the hot-air inlet to the carburetor.

To Develop Strength in the Wrist and Fingers

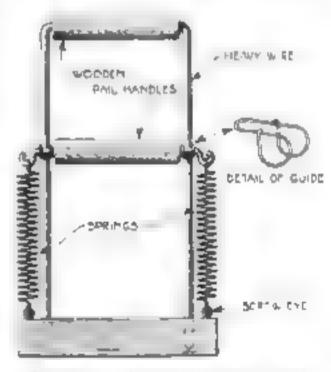
THE little device shown in the illustration is called a grip machine because it is intended to develop the strength of the wrist and fingers. It is used by squeezing the movable crosspiece until it reaches the other crosspiece. This operation practised with both hands each day for fifteen or twenty minutes, will strengthen your grip and enable you to do gymnastic stunts with greater case.

The use of this simple exerciser is equally beneficial in restoring the strength of the hand after it has become weakened through injury

First get a piece of straight heavy wire 1/8 in. thick and 28/4 in. long. Sharpen each and with a grindstone or file. The handles or grips are made from wooden pail handles 3% in. long. Mark the wire with a acrape of the file 9% in. from each end. Slip the pail-handle on and fasten it between the marks by foreing aluga of wood into the hole, then bend the wire at each mark

Take a piece of wood about 6 in, long and 1 in, square. Drive the ends of the wire into the wood about 1 in, from each end as shown in the illustration.

Take another piece of wire of the same thuckness 6 in. long. Mark it 1½ in. from each end. Slip on the



Persistent and regular exercising with this device will give greater strength to your grip in a short time

pail-handle and fasten it between the marks as you did the first. Bend the ends as shown and make two guards of a piece of thin were to keep the crosspiece from pulling away from the long wire. The guards should be large enough to allow free movement of the crosspiece and should be oiled to prevent wear.

Screw two screw-eyes into the wood as shown and fasten 2 large springs—one from each aide of the crosspiece—to each acrew-eye. The wire can be obtained in a tinamith's shop and the springs will be found in a hardware store.—Walter Thompson.

Through a 4-in.Wrought Steel Pipe in 110 Seconds

Just before this photograph was taken, the operator released the ratchet controlling the speed, and the saw actually slashed its way clear through the four-inch wrought steel pipe in one minute and fifty seconds.

This circular, metal-cutting saw, with special teeth inserted close together and each series of four to six interlocked, is a Disston invention. Wherever used, it greatly reduces the cost of producing steel of irregular shapes such as castings or railroad tracks.

The fundamental quality of all Disston Saws and Tools lies in the Disston-Made Steel. For generations the workmen have produced the finest steel suitable for each article in the Disston list. until these men know steel as few men in the world can know it.

> HENRY DISSTON & SONS, INC. Philadelphia, U. S. A.



A List of what Disston makes - including The Saw Most Carpenters Use

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Swages Mittie-box Saws Cylinder Saws Drag Saw Blades Pruring Sawa Machetes



Bowels-Brick Partnering, Perceting, etc. Kniver - Cane. Corn. Findge Walse, Terreing and Follow

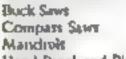
Veneoring Save Screw-slotting Save



Tow Saws Hodge Sheart File and Rasps Back Sawr

Plumbs and Levels Gauger-Carponterr Marking.etc Band Saws for Wood and Mutal Grooving Saws Known — Machine

Cross-cut Saws and Tools Buck Saws





Hand Penel and Rip Seve Inserted Tooth Circular Saws Milling Savet for Motal Shingly Saws Levels - Carpontees and Masons'



Screw Drivers Saw Gummers Stave Sawa Plumberr Sawt

(butcher Save and Blades One-man Cross-cut Saws Saw Screws Tool Steel

Sugar Beet Knivet Squarer-Try and Mitre Siate Saws - Circular Hack Saw Blades Keyholo Saws Segment Saws Kitchen Saws Carcular Saws for Wood. Motal and Slate





SAWS TOOLS FILES

All Sorts and Conditions of Steel

By Donald A. Hampson

WITH the advent of the automo-bile came the wide use of alloy steels and of the term "alloy steel" in the nomenclature of the machine trades. And as the automobile has become a necessity, people who never knew and never cared about things mechanical have become interested to the extent that a great deal of general information that was heretofore trade talk is today part of the man-in-thestreet's vocabulary

The automobile is largely responsible for the general use of alloy steel and for its use in other lines requiring high duty, but the elements that produce these advanced results were known many years before and such steels were produced and used in limited quantities. Also there are other steels that the machinist encounters at times and that are of much general interest, but that have not received the advertising that has marked automobile materials.

The Chemistry of Steel

The chemistry of steel is of the nimost importance today. Without going into that, it may be said that changes of 1/10 of 1 per cent in the amount of certain elements will make a considerable difference in the working of a piece of steel and the service to which it is adapted. A number of the striking changes in properties and the use to which such steel is particularly suited will be mentioned.

First, one or two facts should be fixed in mind. We have mild, or machine, steel, which is the most valuable atructural material we know; roughly, it is a combination of iron and carbon, but with not enough carbon in it to make it a hardening steel. Then we have carbon steel, containing 0.60 per cent or more of carbon—steel that will harden, showing in the bardened state greater strength and the ability to cut other metals. If it were not that the hardness is always accompanied by brittleness, carbon steel would answer for most of the purposes where alloy steel is now used, both in construction and as a cutting steel. The increase in strength—and in brittleness—is in direct proportion to the amount of carbon added. A carbon content of 1.20 per cent is rarely exceeded in straight carbon steels.

Manganese Steel

Manganese steel is the oldest of the so-called "alloy steels." About fifty years ago, Hadfield's manganese steel was brought out for cutting-tools and marked a wonderful advance in the art, for it would stand up under far greater speeds than carbon steel. It hardens in air and from that quality it early acquired the name of "self hardening." Until the advent of highspeed steel, self bardening occupied the foremost place for cutting-tools and is still in demand for many classes of work. In its composition there is 12 per cent of manganese and about one per cent of carbon.

Every one knows that the plunging of a piece of red-hot steel into water causes it to harden, if the steel is of the proper grade. It is the element of carbon that brings about this change. Unless the brittleness is reduced by tempering or there have been other elements introduced to prevent this extreme hardness, the piece of hardened steel is almost as brittle as glass. and can be shottered by a blow from a hammer. One notable exception to this is found in steel alloyed with manganese—not the composition noted above for cutting-tools, but a composition for structural purposes, the most notable example of which is the use in safe and vault building. The manganese steel of this grade is bested and plunged quickly, just as as carbon steel, and while it becomes very hard. it does not get brittle as does the latter, but is ductile and will regist almost any amount of hammering without fracture. After hardening, it cannot be cut with tools—all surfaces that require machining have to be ground.

Still other compositions of manganess steel are highly valuable for modern uses. The non-shrinking die steel, so prized by our tool-makers, contains about 1.60 per cent of manganese along with 0.90 per cent of carbon, When it is considered that ordinary tool steel will change its size several thousandths of an Inch when plunged hot into water, the value of a steel that does not change at all is at once apparent, particularly in the case of an expensive die, one whose shape precludes any correction after it is hardened. The addition of from 5 per cent to 14 per cent of manganese to steel renders it non-magnetic and a poor conductor of electricity, features that make it descrable in the construction of many kinds of electrical appa-

Tungsten Steel

High-speed steel, the undefeated rival of Hadfield's manganese, contains 18 per cent of tungsten and about 0.65 per cent of carbon (enough carbon to make it harden). It is the possessor of the wonderful property of remaining hard at all temperatures up to and including a dull red heat. This is very important in modern machineshop practice where such a cutting speed must be maintained that heats the chips to a temperature of 600° or over and where the tool gets even hotter and must run so for hours. In point of actual hardness, carbon steel exceeds high-speed steel, but the

former loses its "temper" at a little over 400° and so must be used at vastly reduced speeds. High-speed steel, once hardened, is practically self hardening, for nothing short of long hours of treatment will change its nature to where it can be machined again. This steel is not used for anything except cutting-tools. During the early days of the war, its price rose to nearly four dollars a pound and still remains well over half that amount.

Tungsten steel of a lower grade is used extensively in electrical and instrument work. It has the property of retaining its magnetism for long periods, once charged. This makes it ideal for permanent magnets as well as in the more delicate work of compani-

needieu.

Silicon Steel

Another steel prominent in electrical work is silicon steel. It finds its use in electromagnets up to the largest sizes; it has a greater permeability than the purest of wrought iron, and a high resistance. An interesting difference will be noted in the last two paragraphs—tungsten steel for permanent magnets, allicon steel for electromagnets.

Nickel Steel

Nickel steel is one of the most valuable of the alloys. It came into prominence twenty-five years ago when nickel-steel bicycle tubes were made for use in the Cotumbia bicycle—a steel with 5 per cent of nickel that gave greater strength with much less weight. Today nickel steel is widely used in marine work for engine and ship forgings, having practically displaced all other steels. Armor-plate is made of nickel or chromium steel or steel with these two elements combined in various proportions. Armor-plate with a composition of 314 per cent nickel, 136 per cent chromium, and 0.25 per cent carbon can be pierced by a projectile which, if powerful enough, will go through, leaving a clean hole (as if by a punch, with no cracks radiating from the hole.

Other properties of nickel steel are ita resistance to wear. Nickel steel rails last nearly four times as long as ordinary rails, and thus railroad officials specify them for the hardest service on curves. Nickel steel has a high tensile strength and a high permeability. Twenty-five per cent of nickel renders the steel non-magnetic, though this is seldom required (note that 5 per cent to 14 per cent of manganese does the same thing). A composition of steel with 30 per cent of nickel is practically non-corrosive; such steel is used extensively for boilertubes where its consequent long life



et's Tru that Trail, Kate"

"T'S a steep grade, but we can make it. You won't be scared, will you?"
"Of course I won't, silly. I'd go anywhere with you, Jim—and a Harley-Davidson!
And just think—with all the rough roads and hills we've been over this afternoon, we haven't used up sixty cents' worth of gasoline!"

"That's just like a woman-figuring out pennies! But you're right, Kate. There's no 'high cost of motorcycling."

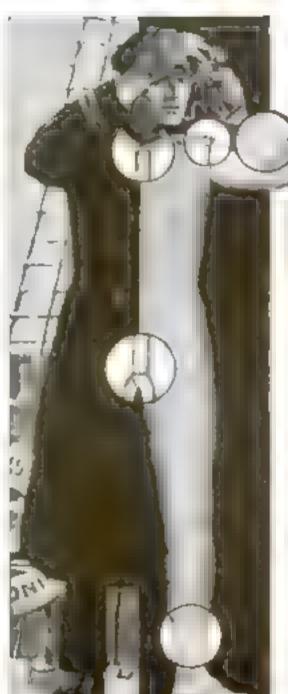
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EXTRA wear, extra warmth and extra comfort are built into "Hanes" winter underwear for men just as accurate time is built into a good watch! "Hanes" is made with one ideal in mind—that it be the greatest underwear value ever sold at the price!

Your own test will prove that it is—and it will also prove why our guarantee on every "Hanes" garment is so broad. We know what goes into "Hanes"—and what "Hanes" must deliver to you in satisfaction! You can feel that thrill of contentment the moment you put on "Hanes" underwear! "Hanes" never disappoints!

HANES" heavy winter weight union suits and the new slik trimmed, I full combed yers medium weight union suits (carrying the yellow Hanes label) have the non-gaping tailored collarette and elastic knit, shape holding arm and leg cuffs; buttonholes last the life of the garment, an extra guiset assures extra comfort across the thighs; the "Hanes" closed crotch stays closed; peach buttons sewed on to stay; reinforcements attempthen every strain point.

"Hanes" heavy winter weight Shirts have the snug-setting elastic knit colleratte and arm cuffs. Drawers have an extra wide, durable 3-button sates waist band that assures comfort and service.

Union Suits for boys are unmatchable!

"Hanes" Union Suits for boys are unequalled at the price for fleecy warmth, form fitting comfort and wear-service. They are wonderful value because they give such extraordinary service!

Made in sizes 20 to 34, covering ages from 2 to 16 years, 2 to 4 year old sizes have drop seat. Four desirable colors.

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P. H. HANES KNITTING CO., Winston-Salem, N. C. New York Office Warning to the trude: Any gardent affered as "Rance" is a substitute unless it bears the "Hance" label.

Next Summer-You'll want to ever Hanes Nainswel Union Seite!

makes it the cheapest material in the end in spite of its high first cost. Other applications where there is exposure to water and vapor show the same freedom from constant renewals.

Chromium Steel

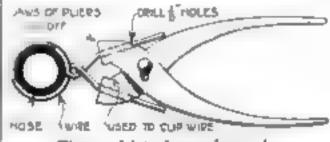
Chromium steel with a high percentage of chromium resists oxidation and corrosion well. But it is in armorplate that this alloy steel really shines at the present time. The great bardness in the face of the plate and the great toughness at the back are secured by chromium as in no other way. From 2 per cent to 4 per cent of chromium allows the lowering of the carbon content without affecting the bardening of the steel and then the undesirable quality of brittleness is not present to an alarming extent.

This brief review of apecial steels will show the degree to which the steelmaker's art affects those things upon which our modern life depends. And that without touching the alloy steel as applied to automobile crankshafts and gears, or the steel that goes into the great bridges and from that down to the common implements of farming. These latter uses of mild steel-steel that before the war brought around three cents a pound-have been promoted and made possible at a low cost because alloy steels have been found ready for cutting-tools and for highly stressed parts. The mousetrap sold over the counter of five-andten-cent stores was made salable at that price because high-speed steel tools were used in its manufacture and the bridge over which speeds the twentieth-century train is made safe by the use of alloy-steel pins at critical points -steel that is scientifically compounded and treated.

For Binding Hose Clamps with Wire

To bind hose with tight wired connections a tool can readily be made from an old pair of pliers, even a pair with the ends broken.

Saw or grind the ends flush and drill with two 16-in, holes as shown in the



This sucfut tool may be made from an old pair of pilers

sketch. A U-shaped piece of wire is cut and the ends are placed through the holes after surrounding the hose. Twisting the handles makes a clamp that is both tight and inexpensive. Wire up to ½-in. in drameter can be used with this tool and wired patches about pipes, tanks, etc., can be made securely.—G. A. LUERS.

An Adjustable Light Fixture for the Drafting-Table

FOR use above the drawing-table or over the desk an adjustable light fixture that is simple in construction, positive in the setting, is shown in the illustration. This consists of an ordinary half-round reflector secured about the lamp socket. The socket is acrewed to a piece of brass tubing and



Here is one way to get good light, just where it is needed

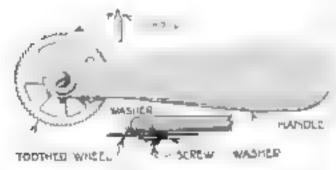
the lamp wire led through this. A short section of pipe split lengthwise with two cuts for the tubing and a set screw is for purposes of adjustment. A second section of tubing, with a circular bend in the extreme end, rests in a piece of angle-iron through which a hole slightly larger than the tube is druled. The overhang of the lamp causes the tube to hold firmly in the bracket.—G. A. LUERS.

A Clock-Wheel Serves as a Paper-Perforator

A PAPER-PERFORATOR is easily made from an old clock-wheel.

Bevel the wheel on both sides until quite sharp. Now get a 34-in. brase-headed screw, two small brass washers such as are used in electwork mechanism, and a piece of wood to form the handle.

Place a washer on each side of the wheel, insert the acrew, and attach to



An old clock-wheel and a wooden handle make a good paper-perforator

the wooden handle so that the toothed wheel protrudes beyond the handle end.

This tool, drawn along a page, perforates the paper quite easily, and notebooks with fast leaves may be provided with detachable pages in a very short time.—George H. Holden.



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POPULAR SCIENCE MONTHLY
235 WEST THIRTY-NINTH ST, NEW YORK

How Tool Steel May Be Case-Hardened

I is necessary for toolmakers to case-barden many tools and tool ends, such as wrenches of the S shape and straight-end styles, in order to prevent serious wear. There are many other tools which would last longer without becoming misshapen were they case-bardened after being drossed up and before use. The following method of ease-hardening good grades of steel may be employed

First, secure or make a little wrought-iron box, the size depending on the length of the tools or pieces of steel to be hardened. This box of thin iron may be shaped like a eigar-box and have a hinged lid or otherwise, just so that it may be sealed air-tight with fire-clay or such matter between the lid and box. When such a box is prepared, secure enough bone-dust to hearly fill this box. Next, cover



Case harden your tools. They will last much longer

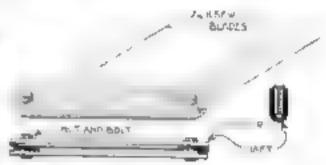
the bottom of the box with said bonedust about an inch deep and place the tools or steel parts in this bed -being sure that no parts come in contact with each other or the sides of box. If more than one layer of steel parts is to be hardened, place another layer of bone-dust over the first layer of steel parts and then another layer of steel parts, then more hone-dust, until the box is packed tightly. Seal with fire-clay or other such substance, or pack lid of box with arbestos to secure an airtight box under heat. Then you are ready to give the box and contents the required heat and cooling treatment to produce case-hardening.

When all is ready for the fire, heat box and contents to a cherry-red heat and maintain this heat until you are aure the pieces of steel inside are thoroughly heated, which may require 15 to 20 hours, after which remove box and contents and quickly cool tool ends or the whole in a pail of lukewarm water. A pinch of salt will help. If this fails in results, repack and heat for a longer period, as the carbon from the bone-dust must penetrate the steel to give it hardness.

Making a Useful Hacksaw for the Pocket

A GOOD way of utilizing broken hacksaw blades is to make a holder, or halt, similar to a pocket-knife.

Take a 4-in, length of }2-in.-diameter brass gaspipe, cut down on one side lengthways, and then fiatten with hammer until a turn cap U shape is formed, just of sufficient width to re-



This shows how to make a folding backnew from broken blades

ceive two thicknesses of the sawblades.

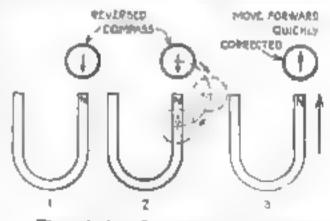
Half an inch from both ends bore a 3-in. hole, insert the eyelet end of a piece of the saw in haft, together with a clockmaker's small washer, and tighten up with small bolt and nut or a set screw.

The saw-blades, when not in use, will then fold over and fit in the haft like a penknife, and may be carried about in one's waistcoat pocket with ease.—George H. Holden

To Reverse the Polarity of a Compass

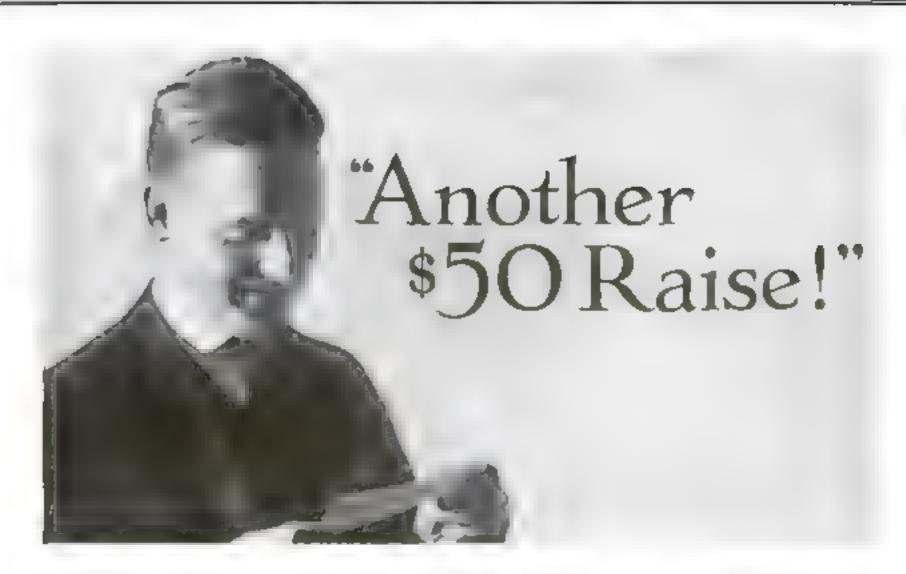
SOMETIMES a small compass becomes reversed through carelessness in using it near a strong magnet. As it is almost useless in this condition, it must be restored to its original polarity, but how to do this without removing it is usually a puzzle.

The compass, held level so that the needle is free to move, is brought to the pole of the magnet, which it will naturally seek. It is then brought around in a semicircle, allowing the



The polarity of a compass may easily be corrected, as described here

brings it over the pole. The compass is now moved forward quickly so as to catch the other point of the needle before it can get away. As this is the correct polarity, the compass is tapped a few times against the magnet to settle the molecules into place and the trick in done. -ROBERT A. CHANDLER.



"WHY, that's my third increase in a year! It just shows what special training will do for a man. When I left school to go to work I couldn't do anything in particular. All I could hope for was just a job—and that's what I got, at \$60 a month for routine, unskilled work. I stayed at it for three years, with one small increase each year.

"Then one day I woke up. I found I wasn't getting ahead simply because I couldn't do any one thing well. I decided right then to put in an hour after supper each night preparing myself for more important work. So I wrote to Scranton and arranged for a course that would give me special training for our business.

"Why, in a few months I had a whole new vision of my work and its possibilities. You see, I was just beginning to really understand it. I made some suggestions to the manager and he was immensely pleased. Said he had noticed how much better I was doing lately and wished he had more like me

"Just after that an opening came and he gave me my chance—at an increase of \$25 a month. Then I really began to grow. Six months later I was put in charge of my department and my salary went up again. Since then I've had

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two increases of \$50 a month and now I've got another

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In days gone by, mother mixed a mustard plaster when father had bronchitis or brother had the croup, but now she uses Musterole. It is better than a mustard plaster.

She just rube it on the congested spot. Instantly a peculiar penetrating heat begins its work of healing -and without fuss, or muss or blister.

Musterole relieves without discomfort

The close white cintment sets your skin a-tingle. First, you feel a glowing warmth, then a picatent lasting coolness, but way down underneath the coolness, old Nature is using that peculiar heat to disperse congestion and send the pain away.

Made of oil of mustard and a few home simples, Musterole is uncommonly effective in treatment of the family's little life. It takes the ache out of grandlather's back. It soothee slater's headache. It helps mother's neuralgia.

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Make a Pocket-Bib for Your Baby

THE pocket in the bib described here extens the crumbs and food particles which the baby drops from mouth and fingers, and prevents them from falling on the clothing or floor

The bib is made, like a majority of



baby bibs, preferably of rubberised or other waterproof fabric.

To make the pocket, lay the bib on a sheet of paper—about one third the distance from the bottom to the neck, as shown in Fig. 1.

Draw the bottom outline of bib on the paper. Around this draw another line, distant from the first line, 🔩 in. at the bottom, flaring to 1 in. distant at the top edge of paper

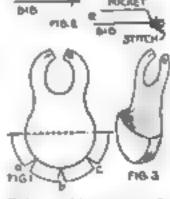
At the points A, B, and C, mark V-shaped notches as shown, so that the projecting pieces left shall be the same length at their outer edges as along the inner line.

Using this as a pattern, cut out your pocket, allowing enough margin

outside the lines for a seam, and the same along the V cuts. Seam the edges of the V rute together.

Place edge of pocket against back edge of bib and stutch flat. as shown at Fig. 2D.

Turn, bringing pocket in front of bib,



Pollow this pattern for making one of these useful bibs

and stitch through, as close to edge sa possible, making a turned edge as shown in section at Fig. 2C.

Bind top of pocket with tape.

The bib complete is shown in perspective in Fig. 3. The mother may add some individual, artistic touches to her work, but, remembering the purpose for which it is intended, she should avoid everything that would make it difficult or impossible to clean the hib after use.—CHARLES A. PEASE.

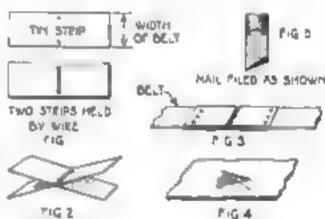
A Flexible Fastener for Small Belts

N such places as printing-shops and other places of business where conveyors are used, the need of a small flexible fastener for connecting the ends of small beits together often

The writer was recently confronted with the task of equipping a large blueprinting machine with new elastic bands. The old ones had lost their elasticity, the main quality required of them in the rolling of the printed sheet after it had been developed and dried. Wire was first used, but the ends soon frayed and pulled apart. A more substantial method, which has worked perfectly for some time, was employed in the following manner:

Pairs of tin strips, the width of the elastic belt and 3 widths long, were cut from sheet tin and small holes punched near their edges, as shown in Fig. 1, on a line running through their centers. These holes were punched through with a nail set and ground smooth. Small wires were then cut into short lengths and put through the holes and the ends clenched over, holding the two strips firmly together, also shown in Fig. 1.

The ends of the strips were spread with a knife-blade wide enough to



Every step in the making of this flexible belt fastener is here clearly illustrated

grasp with the fingers (see Fig. 2) and the bend was completed as in Fig. 8 It will be noticed when this has been done, that a simple binge has been made, which is held together by the doubled wire.

This is now ready to attach to the belt ends, with the exception of punching the tooth-like prongs that dig into the belt, when fastened, and prevent it

from pulling out.

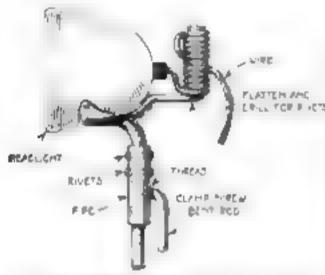
To make these prongs, procure a small hail, and grind the end to a three-cornered point. This should consist of two broad surfaces and one narrow one. Then finish by grinding off the point until the end of the nail appears as shown in Fig. 5. This, when driven through a sheet of tin, makes a mark similar to the one shown in Fig. 4. By making a row of these marks with the prongs along each edge of the connectors, as shown in Fig. 8, the ends of belting or webbing will not pull out when it has been clamped down with a pair of phers. When using the punch, place a thin strip of wood

between the sides of connectors and be careful not to cut through both sides at once.

This fastener will hold indefinitely, providing the strain thereon is not excessive. Dalle R. Van Horn.

An All-Purpose Headlight for the Automobile

A DETACHABLE headlight fixture as shown in the accompanying illustration affords a convenient feature for tire repairing and roadside or garage repair work on the engine or transmission. The lamp support is cut and a detachable joint made as

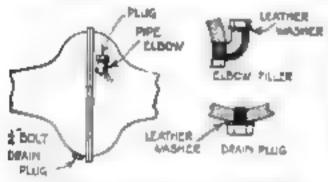


This headlight is removable and may be used to advantage when repairs are being made at night

shown. This joint is a section of tubing riveted to the lamp bracket with a
clamp screw to engage the support on
the car. A section of tubing riveted to
the body of the lamp serves as a handle
and also as a reel for winding up about
twenty feet of lamp wire. This attachment is suitable for either the private
car, any truck, or the garage service
car.—G. A. Luers.

Care and Treatment of the Main Driving Gears

THE section of the rear axle-housing for an automobile enclosing the driving-gears is in a large number of axles only provided with an aperture



Provide a drain-plug for your differential casing and you can flush the gearing

for putting in the lubricant. No means of draining is provided and in consequence the casing is not cleaned or emptied until the axle is overhauled. By adding a 1/4-in, drilled hole and a tapped-in plug to this case, periodical cleaning and draining is readily done, in consequence of which the life of the gears and bearings is extended.

The filling hole should also be pro-



The Contributions of Science

The greatest material benefits the world has received have come from the laboratories of the scientists. They create the means for accomplishing the seemingly impossible.

Science, after years of labor, produced the telephone. From a feeble instrument capable of carrying speech but a few feet, science continued its work until now the telephonevoice may be heard across the continent.

In February of 1881 a blizzard swept the city of Boston, tearing from the roof of the Bell telephone building a vast net-work of 2,400 wires. It was the

worst wire disaster the Company had sustained.

Now through the advance of science that number of wires would be carried in a single underground cable no larger than a man's wrist,

As the fruit of the effort of science greater safety and greater savings in time, money and materials are constantly resulting.

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Washington School of Art, Inc. Room III2 Marden Bldg., Washington, D. C. vided with an elbow connection, such as is obtainable at plumbing supply houses, to facilitate filling with oil.

The differential housing contains 8-in gears, their bearings, and 2 quite soft babbitt thrust-bearings in addition to a ball thrust and roller radial bearing on the driving pinion. These parts rapidly contaminate the oil with much metallic grindings or slivers that cut the bearings rapidly, especially the babbitt, and throw the gear teeth out of alignment.

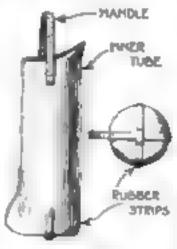
By draining the case, flushing with kerosene, and refilling every six months with fresh oil, the life of the axle is doubled.—G. A. LUERS.

Another Use for Old Inner Tubes

AN emergency water-bucket can be made from an 18-in, piece of a discarded inner tube; the 4 1- or 5-in, sizes are preferable. If possible, use the place where the tube has been set together as the top of the bucket. The lower 3 in, is slit in four places, then

turned under and cut so that the edges fit perfectly and form a bearty flat bottom.

Now treat
these edges us
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cut in an inner
tube when
about to repair
st; while the
rement is drying, cut two
7 by 1 in. stripe
of patching



A side and bottom view of the bucket

material and apply them over the edges. Also cut two 12-in strips 1 in wide. Apply a thin cost of rement to the gummed side of one, starting 2 in. from the one end and stopping 2 in. from the other. When sufficiently dry, press the two 12-in, strips together. They form the handle and are attached to the upper end of the bucket by cementing the tube between the loose ends.

To make pouring easy, a lip should be cut on the concave side of the tube, and if desirable one of the strips at the bottom can be cut 10 in. long and attached. It also side is pouring. A bucket 15 by 6 in. expands with the weight of water enough to hold ½ gal, with case.

How to Make a Drill-Press for the Bench

VARIOUS pieces of wrought-iron pipe and pipe fittings as shown provide, in conjunction with an electric hand drill, a substantial bench type of drill-press from which the hand drill can be removed readily when desired.

This will apply to practically any type of electric drill with a detachable or screwed handle. With a drill of the



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BUCHSTEIN'S FIBRE LIME

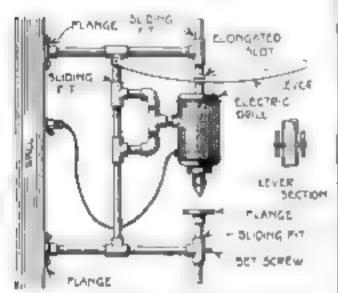




rigid-handle type a bolting figture to attach to the handle can be made when desired. This drill fixture consists mainly of 3 pipe flanges, 2 elbows, and 6 "tees" joined with screwed sections of pipe of a size corresponding to the attachments used.

Two pipe flanges secured to the side wall are the supports. A third flange screwed to a section of pipe is a removable table.

The sliding "tees" on the vertical pipe and the vertical attachment above

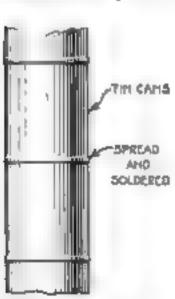


Build this drill press from pieces of pipe fittings and an electric drill

the drill prevent lateral movement. A simple lever, which increases the pressure on the drill above that applied to the end, is the means of feeding the drill point into the work. This attachment affords the maximum usefulness of the drill with only a slight expenditure for material and the time neceseary to assemble this.—G. A. LUERS.

Tin Can Rain-Pipes to Save Money

TERY good rain-pipes or leaders can be made of tin cans. The first step is to remove the top and the bottom of each can. The solder can be melted away by putting the cans on a hot stove. After the tops and bottoms have been removed one end of each can is expanded slightly so as to receive the end of the next can. The came are then soldered together, a little extra solder being applied to the joint at the side which may have become weaken-



Empty tip cans can economically used for making

ed during the melting away of the top and bottom. Δa each can is soldered to the other it is given a cost of paint inside and out. In thin way a very durable rain pipe is formed that aziswers every purpose required. — S. LEONARD BASTIN.



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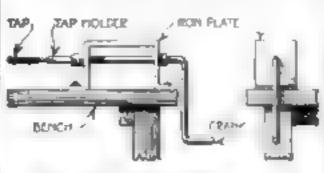
SHAW MANUFACTURING CO. Calcaburg, Kuman



Make a Tapping-Machine at Home

You don't have to purchase a high-priced tapping-machine if you adopt the idea shown in the accompanying sketch.

Rig up on a beach a piece of iron of the shape shown, place through this a shaft with a handle and you have a tapping-machine. The square end of the tap fits into a square hole of the



If you have much tapping to do, you will find this lettle machine a great help

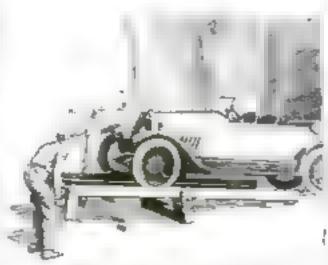
tap-holder sleeve. With this machine you can tap all sorts of work at very little cost. The aleave that holds the tap is removable, so that different sixed ends to suit different sized taps can be

This simple machine means added production wherever holes have to be tapped, and, what is more important, it menns fewer broken tupe.

A Special Stand to Facilitate Car-Repairing

IN the small repair-shop it is not always convenient or practical to have a work-pit or a permanent elevated platform for removing the automobile far enough above the floor to give free and easy access underneath. A stand that is portable and on which an automobile can be placed in an elevated position is shown in the accompanying illustration.

it consists of two longitudinal rails of wood, 10 ft. long. A center support with two pivots about 24 in high forms a trestle on which the automobile is pulled by means of a winding-bar,



Repairs are made much estier if the automobile stands on this trestic above the floor

crank, handle, and rope, with a book to attach to the front axle of the automobile. Two fixed blocks on the forward ends of the rails with two swing-

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SIMPLE WIRELESS TELEPRONES AND HOW TO MAKE THEM. An elemental front on the principles, construction and the of an are system of window, taleplace. Proc. 25 1950 postpaid. Pook Department, Popular Science Monthly, 225 West 38th Street, New York City.

ing blocks on the rear ends rigidly support the automobile after it is pulled into place and the forward end lowered.

On account of the angle of the incline and the possibility of over-running, the winding-drum should be the means of getting the automobile on the rails. Two wedges forward nailed in place will prevent the automobile from creeping to the front. Wedges are also placed under the rear wheels. When not in use, the parts are readily disassembled and placed aside.

The Triangle in Drawing Wood Grain

MANY draftsmen, when they have occasion to show the grain of wood in their drawings, like to have the grain more uniform than they can draw it freehand. This is especially desirable in patent and other technical or conventional drawings.

The accompanying illustration shows the bow a triangle may be shaped to



Draftemen who find it difficult to draw wood grain may use a triangle for the work

imitate wood grain. This can be done with an ordinary penkulfe. Care must be taken to leave intact about 34 in. of each end of the triangle side to be cut (see the sketch), in order that the wavy side will be 90 degrees to the other side of the triangle, thereby leaving the angle perfectly true.

A Mixture for Hardening a Soft Grindstone

Possessing a grindstone which was soft and had deteriorated with age, I hardened it as follows

Take 22 parts of rock crystal and an equal quantity of minium to 60 parts of powdered glass, 1 part arsenic, 5 parts of saltpetre and 15 parts of calcined borax.

This should then be made into a paste with water, and applied to the stone, after which soft stone will be rendered so hard as to emit sparks when struck with merely a pocket-kmfe.

Soft building stone, deteriorating through weathering, may also be similarly treated.—George H. Holden.

Ward off pains and stiffness After exposure

AFTER having been at work all day, standing on your feet, lifting heavy weights or "sloshing" around in the wet on a rainy day, it's a good thing to have a bottle of Sloan's Liniment handy at home or in the shop.

Apply it freely, without rubbing, to the strained muscle, rheumatic joint or aching back, and quickly comes grateful warmth and relief.

For 39 years, Sloan's, the World's Limment, has been the enemy of rheumatic pains, neuralgia, lumbago, and the hosts of "external" aches and pains that lie in wait for the person exposed to the weather or subject to heavy and continuous work.

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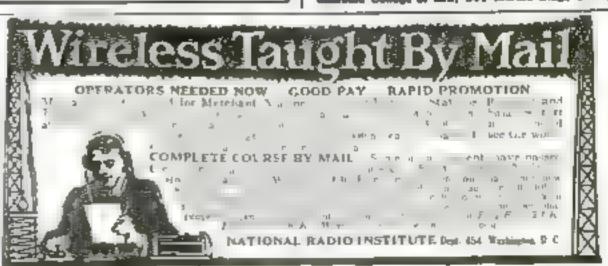
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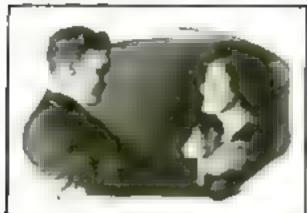
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A Big Raise in Salary

Is Very Easy to Get, If You Go About It in the Right Way

You have often heard of others who doubled and trebled their salaries in a year's time. You wondered how they did it. Was it a pull? Don't you think it. When a man is hired he gets paid for exactly what he does, there a no sentiment in business. It's preparing for the future and knowing what to do at the right time that doubles and trebles malaries.

Remember When You Were a Kid

and tried to ride a bike for the very first time? You thought that you would never learn and then—all of a sudden you know how, and said in surprise: "Why it's a cinch if you know how." It's that way with most things, and getting a job with big money is no sucception to the rule, if you know how.

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Without loss to you of a single working hour, we can show you a sure way to success and big pay. A large number of men in each of the positions listed are enjoying their salaries because of our help—we want to help you. Make check on the coupon against the job you want and we will help you get it. Write or print your name on the coupon and send it in today.

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A Good Way to Cool Milk Without Ice

In the absence of ice, the common method of cooling bottles of milk and other foods is to set them so that the water flowing from the faucet falls upon the top. If it is a bottle of milk, the water spatters and but little flows down the sides of the bottle. If the



You need not drink lukewarm milk. If you have no ice-box, put the bottle under the cold-water faucet

bottle is placed so that the stream of water strikes only one side, the process of cooling is even slower.

In the accompanying illustration a scheme is shown which works well. If a small cup or butter-saucer is inverted over the top, and then placed under the faucet, the water, when turned on, will run down all sides of the cup, and, upon reaching the lower edge, flow under and directly onto the bottle. If this is tried, it will be seen that the dish and bottle may be placed in such a way that water flows down the sides uniformly.—Dalle R. Van Honn,

Eliminating Coupling Noises in Your Engine

AUTOMOBILE generators and magnetos are driven by coupling from the water-pump shall

When the coupling is new and all its surfaces are fitted tightly together, it works quietly and efficiently; but

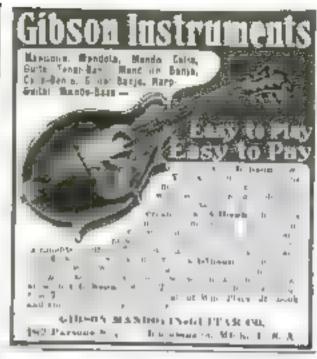


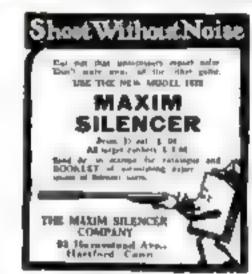
Noisy couplings can be alenced by a leather cover after being used some time, it makes a chattering or squeaking noise.

To put in a new coupling is a very difficultion, as the magneto must be removed and timed

over after the new coupling is inserted.

An easy way to overcome this difficulty is to make a small leather cover to fit over the coupling. This can be clamped into place by two tin clips bent up and held by two small bolts, as shown in the illustration. A small bole is made in the side of the cover to allow 'the tip of an oil-can to be







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Marking Metal Surfaces in an Accurate Manner

SHOULD you need to mark, or graduate any flat metal surface, look at the illustration and you will discover about as simple a method as can be found, yet accurate in every

Grand your chisel point to the shape shown, then fasten an ordinary scale to the portion of the piece you want



The spring permits the marker to move from one gradation to the next

marked. The rest in easy. for with the apring blece A, which resta on each graduation of the scale, you can lay out whatever divisions you desire. As you hit the

chisel on the head with a hammer and make one mark, it becomes second nature after a little practice to move the spring part A along to the next indented mark on the scale.-J. W. MOORE.

How to Flare Copper and Brass Tubing

T is always desirable to fiare the ends of copper or breas tubing when fitting it for attachment to carburetors. etc. Many motorists, however, are not so fortunate as to possess any of the special tools on the market for flaring tubes and fear to damage the end of the tube by trying to do the job with ordinary tools at hand.

A very good method to flare tube ends consists in boring a block of bard wood 2 in. thick, 2 in. wide by 4 in. long, and with a 5, 16-in, drill to cut the block in two with a fine saw. This forms the clamp for holding the tube

between the jaws of the vise. the tube being inserted in the hole, and then allowed to project about in. at the top.

Now, an ordinary flathead wood **Icrew** with a body diameter permitting it to fit loosely in the tube is dropped in the end of the tube and

9000 BLOCKS COPPER TUBING

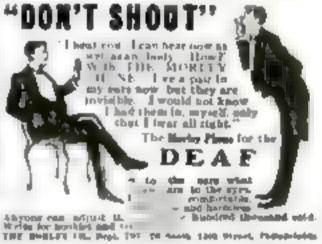
The spilt block holds the tubing. the taper of a screw head does the flaring

then tapped lightly with a hammer. With each blow the screw will turn aightly. After a few taps the tube will be evenly and accurately flared.

If the tubing material is too hard to be worked by this method, it may be softened by heating it in the furnace or over a gas flame until it is red bot and then quenching it in a bucket of

cold water.















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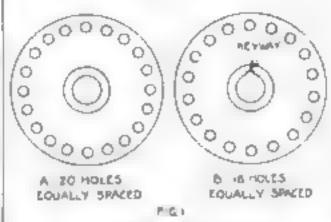
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An Adjustable Magneto Coupling

THE usual means provided for making magneto adjustments on most old types of gas-engines still in service—and on many present types—is by two adjustable flanges on the drive-shaft. One of these flanges has two or three bolt-holes drilled through it, and the other has corresponding elongated slots. By loosening the bolts, slightly turning the slotted flange, and



One of the adjustable flanges has twenty, the other eighteen holes, equally spaced

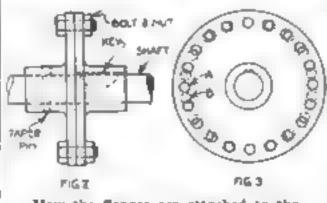
tightening up again, the magneto is synchronised to give its spark at the proper instant.

The disadvantages of this system more than outweigh the advantages. While it is possible to adjust exactly to any desired point, the flanges often ship while in operation as they are held in adjustment only by the grip of the nuts and boltheads.

The accompanying drawings show a flanged connection that can be adjusted near enough to any desired position for all practical purposes, and which cannot shp. Figure 1 shows two flanges drilled for two connection bolts

flange A has 20 holes, and flange B 18 holes. Figure 2 shows the manner of attaching these flanges to the magneto drive-shaft by the usual practice of pinning one flange and fitting the other with a feather key to allow for endwise adjustment.

in Fig. 5 the relation of the holes in the two flanges is shown. The flanges are placed so that the opposite



How the flanges are attached to the magneto shaft and the relations of the boles

holes at A and A are in alinement ready for the connecting bolts. The holes at B and B can be brought into alinement for connection by a very slight turn of either flange. A slightly greater turn will line up the next pair of holes, and so forth, so that very nearly any desired adjustment can be made.

To calculate the value of the smallest possible adjustment it is only necessary to find the angular difference between consecutive holes in the two flanges. Thus flange A (Fig. 1) has the holes spaced $360 \div 20$, or 18° apart. The holes in flunge B are 360 ± 18 , or 20° apart. The smallest adjustment that can be made, then, is 20-18, or 2° for consecutive pairs of holes. By turning two spaces, an adjustment of 4" can be made, and so on around the whole circle by intervals of 2°. Two disks of cardboard cut out and punched as shown will illustrate the principle involved better than any amount of description.

Twenty-hole and 18-hole flanges are taken only for illustration. If closer adjustment than 2° is required, flanges with larger numbers of holes can be used, the only limit being convenience in the diameter of the flanges.

For a 8-bolt connection, the numbers of holes in the two flanges must be consecutive multiples of three. In general, if the number of bolts desired be represented by b, the number of holes in the two flanges will be b x n and b(n+1), where n is any whole number selected for convenience. Also the smallest angular adjustment possible for given values of b and n will be

which simplifies to the form

$$a = \frac{360}{5\pi (n + \overline{1})}$$
.

Luminous Minnows Made at Home

As is well known, the "glowing lure" is one of the deadlest forms of artificial minnows that one uses on base and other fish. These phosphorescent basts are used at night, for it is from six o'clock in the evening to very near midnight that the bass are striking the lure at the best. This is accounted for by the fact that during the hot days of summer the fish feed at night. The glowing lure in the water is seen and on the impulse of the moment are seized by the fish

The knowledge of how to color and make artificial minnows glow at the same time is known to comparatively few. If the following directions are pursued, no trouble will be had in producing minnows equal to the best on the market. Four colors with the glowing combination are given, namely, orange, green, blue, and white.

To produce the orange coloration with the glow to it, take 46 parts of the best spar varmsh, and mix with it 17.5 parts of prepared barium sulphate; add one part prepared Indian yellow; also 1.5 parts prepared madder lake, and 38 parts of luminous calcium sulphide. This gives excellent results, For green take 48 parts of the best

spar varsush; add 10.2 parts prepared barium sulphate. Add 8 parts green chromic oxide, and add 34 parts luminous carerum sulphide. For blue take 42 parts of spar varnish, 10.2 parts prepared barium sulphate; add 6.4 parts ultramarine blue; add 5.4 parts of cobalt blue; add 4 parts luminous For white, use calcium sulphide. silica and whiting, and with this mix in a sufficient amount of spar varmsh: then add a goodly portion of luminous calcium sulphide. It is a good idea to give the minnows several coats of the paint as this gives a good coating. Old minnows can be sandpapered down and treated so that they appear like new.-ROBERT PAGE LINCOLN.

To Successfully Photograph a Blueprint

EVERY one who has tried to photothe unsatisfactory results that are obtained by the usual apparatus, regardless of the detail in the original. The following method will be of interest, as remarkable results can be obtained.

A red ray-filter should be used in the camera and the exposure made on a plate that is sensitive to red light. Precautions must be taken in developing, as the ordinary dark-room lamp will run the red-sensitive plate. Accordingly, this must be done in darkness or with the aid of a special coloracreen on the lamp. When the red-



Blueprints can be photographed by using a red ray-filter and a red semitive plate.

senzitive plates are bought, it is easy to obtain the proper lamp-screen of a complementary shade of green. When such is available, it is safe to perform the development by this green light as no rumous effect will be produced upon the special plate. Care must be used, however, to obtain the shade of green that is exactly complementary to the red-sensitive plate that is used. After a certain amount of practice one will find no difficulty in developing in dark-

By this simple method it is possible to make from even weak blueprints clear reproductions that actually resemble engravings in regard to detail.

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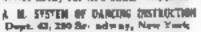
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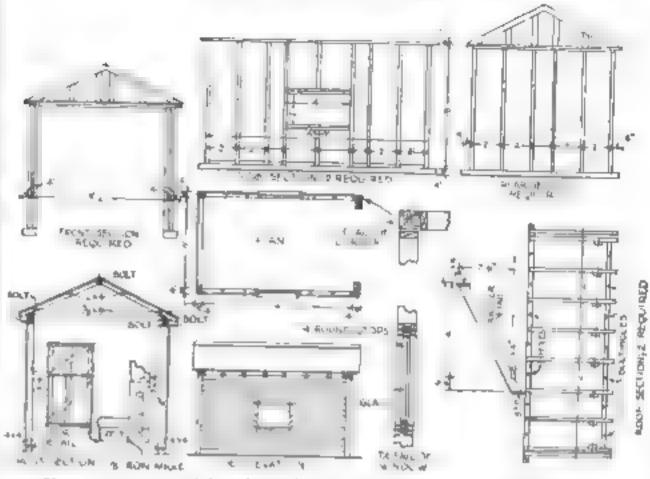
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Make Your Own Sectional Garage

By George M. Peterson



If you own an automobile and intend to build a garage for it, you will save part of the cost by building it in accordance with these drawings and specifications

"HE illustrations herewith show a very easily built sectional garage which will be appreciated by those who have tried to get a contractor to build one for less than two or three hundred dollars.

The drawings give all of the information to frame this building, but the exterior sheathing has been omitted purposely. The garage may be covered with shiplap siding, lap aiding, corrugated iron, or slater's felt, but the most desirable materials would be either

corrugated-iron siding and roof, or shiplap sides and a prepared roof. Corrugated iron may be natled directly to the stude and rafters, but for prepared roofing the roof will have to be covered with boards and the roofing placed upon them. The shiplap siding, if used, may also be applied directly to the studs.

The side elevation shown in the sketch shows lap siding and a prepared roofing which makes a garage fit for any location.

A Simple Automatic Camera "Snapper" for All

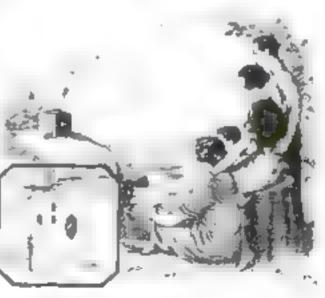
WHEN a snapshot is made of a group, some one has always to be omitted from the group in order that he may operate the camera. The fol-

lowing attabgement makes it possible to include every member of the party without pulling a string

The camera is prepared as follows A piece of string is fied to the lever of the shutter re ease. and alipped over the camera handle or some convenient projection, thus holding the lever up securely. Then a rubber hand is supped

over the lever in such a manner that it pulls downward on the lever. The band is stretched around the camera and fastened in the same manner as the string to the lever of the shutter release.

A coin is placed under the string to protect the camera surface, and the



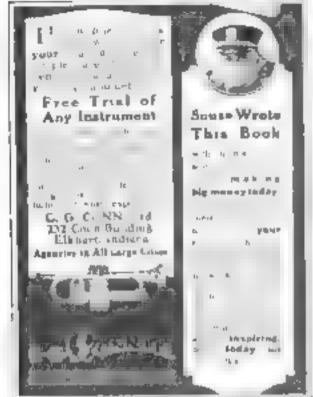
When the fire of the cigarette reaches the string, it will release the shutter

camera is now ready to be placed on some convenient object, such as a stone, post, etc., and focussed on the group. A lighted eigarette or a piece of punk then placed on the string in such a manner that as it burns away it will burn the string. This gives the person preparing the camera sufficient time to take his position in the

group before the shutter is released.

When the string burns through, the downward pull by the rubber hand snaps the shutter —George Frederick.





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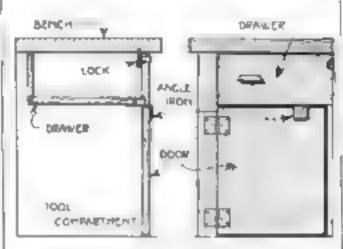
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Locking Tool Compartment with Drawer Lock

T is frequently desirable to provide a compartment under the workbench for tools and equipment too large for the bench drawer

When this is done and it is desired to lock the compartment for safeguarding the tools, a method that does not involve the purchase and installation



When the drawer is locked, it automatically locks the tool compartment

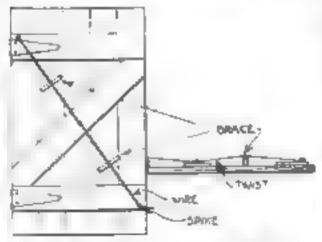
of a special or extra lock consists of having an extended metal plate attached to the under side of the drawer that will butt against the compartment door as is shown in the illustration. The door can be swung on hinges to open to one side, or the hinges can be placed next to the floor and the door swung down.

With this method only the one key and lock are required. -G. A. LUERS.

How to Repair that Sagging Garage Door

ARAGE doors have a habit of sagging after a time, making it difficult to close them properly or else necessitating their removal and planing off the bottom. Unless the door is small or exceptionally well made, planing the bottom affords only temporary relief.

An easy way to effect a permanent cure for this trouble is to drive two spikes in opposite corners of the door as shown and connect them with a few



Supported by the tension wire, the garage door will hang without sagging from its hinges

lengths of strong wire. Place two blocks of wood under the wire, forcing it out a few inches from the door. Take a third spike and insert it between the strands of wire and twist the wire with



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the spike. This will act as a turnbuckle and draw the bottom of the door up. When sufficient clearance to obtained, drive the center spike into the door and you have a permanent repair. In cases where the door has sagged to a great extent, it is better to give the wire only a few turns every day until proper clearance is obtained.

Carrying Excess Luggage on the Automobile

ERE is a simple method for carrying extra suitcases or other baggage on an automobile when equipment is not provided for the purpose.

On the front end of the runningboard six small strap loops may be fastened by wood acrews. Two loops are set in at the rear edge of the board about 20 in, apart. Another two are set crosswise on the board, a convement distance apart. This is governed



By using this method you can materially increase the carrying space of your car

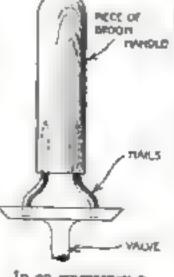
by the size of the package that is being considered. The remaining two are located at the front edge of the board on its under side. The reason for this is that it permits the parcel or baggage to overhang the board. Cord or straps can be arranged to tie or strap over the bundle, the ends being threaded under the loops in a convenient manner.

A New Emergency Ford Valve-Grinder

WHERE a regular grinder tool for rotating a valve of a Ford or similar type of automobile is not avail-

able, an improvised tool can be made in a few minutes from a 5-in, section of a hoe- or broomhandle and 2 nails or 3 32-in. drill-rods.

Drive the stee! pina into the handle firmly. cut off evenly, and bend the points out to correspond with the holes in the valve-head. G A. LUERS.



In an emergency a homemade valvegrinder will do

To Hang Things Upon a Neodla Point

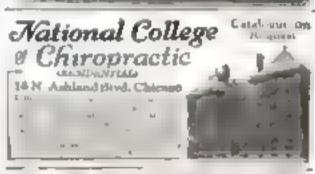
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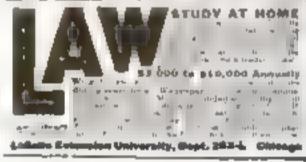
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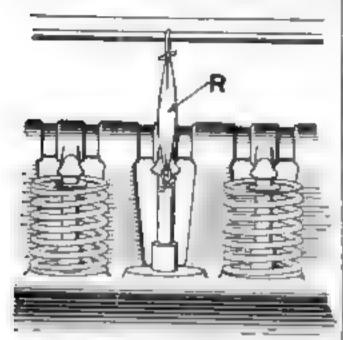
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A Substitute for a Broken Valve-Spring

ISCOVERING that the jerky action of my automobile was caused by a broken valve-spring, I immediately decided I must the the valve stem to prevent it from falling into the cylinder. While preparing to



For a limited tune a strong rubber band will serve as a broken valve-spring

tie the stem, it occurred to me that a strong rubber band might do the work of the coll-spring, at least temporarily. The rubber band R. as shown in the filustration, was attached to the tie-rod directly above the cylinder block and the lower end of it was attached to the notched end of the valve-stem. To my surprise, this substitute worked perfeetly and was used for nearly a week.

How to Change Blue Prints to Brown

CEVERAL years ago I was making quite a number of photographic blueprints. Hearing of a way to change them from blue to brown or sepis color, I tried it with splendid success, and the prints are still as bright and clear as when first made.

Get an owner of tannic-acid powder or crystals. Put into a clean bottle and add just enough water to dissolve nearly all of it. There should be a httle left undissolved in the bottom of the bottle; this gives a saturated solution of tannic acid.

Add one tempoon of ammonia to one cup of cold water; pour it into a tray or other flat dish. Have the blueprint wet, then put it into the ammonia water until it is bleached to a dingy white color. Then dip it into clean cold water, and put into a tray containing the tannic-acid solution.

The picture will soon appear, just as on developing paper. When a deep brown in the darkest places, remove and wash well in running water

Blueprints that have been overexposed so that they are blue all over will be all right when redeveloped this way if care is taken to remove them from the tannic-acid solution as soon as they are sharp and clear, and at once wash them well. CORA HAMILTON.

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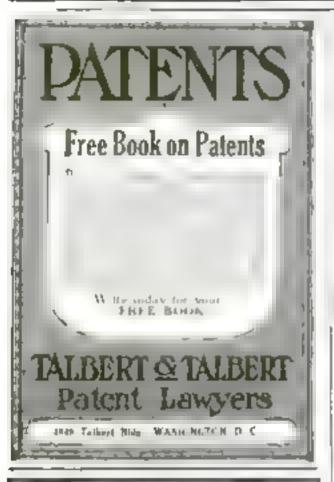
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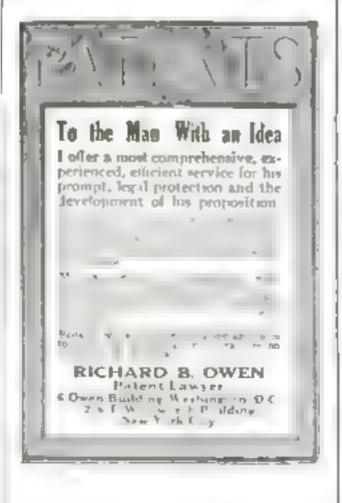
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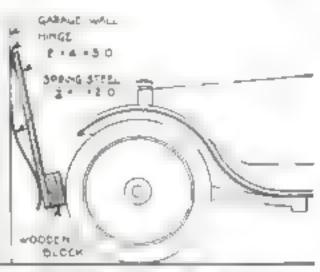




A Bumper for the Private Garage End

CRASH! What was that" Just the bired man running the automobile into the back end of the garage. Another case of the brakes refusing to take quickly enough.

The bumper, which is easily made and will prevent such happenings, is shown in the drawing. Two 2 by 4 are cut 3 ft. long, and hinged, one to each studding, next the corner post at the end of the garage. A block of 4 by 4 of suitable length is then nailed to each lower end and a stiff flat steel spring, bent to the shape shown and drilled for bails at the upper end, is placed behind each 2 by 4 in the



The spring of this bumper must be strong to prevent injury to the recklessly driven automobile

manner shown. If tempered steel is not available, an old wagon tire cut in half will serve the purpose.

The distance from the bumper to the wall will depend upon the stiffness of the spring and the size and weight of the car, but if the lower side of the bumper rests about a foot from the end of the garage, and the springs are ressonably stiff, there will be little danger of severely jarring or starting any of the studding from the foundation.

The sharp corner of the 4 by 4, where it comes in contact with the front tires, may be rounded slightly with a drawkmie. — DALE R. VAN HORN

They Didn't Get Away with It

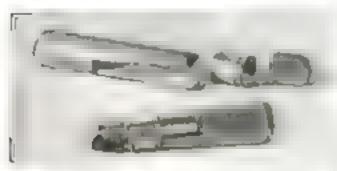
abourd the Lengthen and most members of the crew observed it. - A few, however, went quietly down to one of the lower holds and began to smoke. Two minutes later an officer walked in on them

How did he find out? The men puzzled over this while they went through a round of extra duty for their offense. It seems that the fire-detecting system gave them away. It consists of pipes leading from all the different holds to the bridge. A suction fan constantly draws a supply of air up from the holds to the bridge.

Thus when the men began to smake, a sample of it drifted before the eyes of the officer on the bridge.

This Eraser Handle Is Made of Bamboo

THE hundle of this ersser-holder consists of a section of bamboo cut at the joint to insure strength. The dumeter of the butt is about 1 in The slot is cut deep to allow the use of a full length new rubber. The slot is tapered from the thickness of the rubber at the bottom to approximately



Split bamboo may be used for making an eraser holder like that shown here

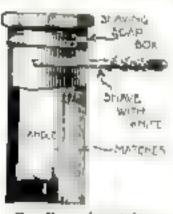
one and a balf the thickness of the rubber at the points. A metal band, preferably of non-exidizing material. such as German milyer, shaped like . an open thimble, is provided, silversoldered at the joint to withstand the burating atrain when in use,

Aside from the economy secured in the use of the rubber (notice the short length in the illustration), the greatest satisfaction is secured to the user by the absence of fatigue and fingercramp whenever much erasing has to

be done .- C. S. BEARDSLEY.

A Waterproof Light for Hunters and Automobilists

WHEN you are on a hunting expedition of an automobile trip. there will often be an occasion when you are in need of light. Matches can be carried in any pocket or matchhox and can be made absolutely waterproof if they are dipped in melted parailin. In windy weather you may have some difficulty in lighting a



Candle and motches are kept water proof un this bes

match, but if you notch it as shown in the picture, ths difficulty will practically van-HB. But match does not burn very long, nor does it give much light.

For cases of emergency, candleattached to the cover of

a shaving-soap box and carried in the closed box to protect it, will be found very convenient. When you need a light, unscrew the cover and use it as a candlestick. Of course the candle can be used only in a place where it is proterted from the wind. In the open air you will have to protect it by putting it incide one of the old-factuoned mica lamp-chimneys open at the bottom. WILLIAM LORENCE.



Yes, I will give you this complete drawing outfit absolutely free. The instruments are regular draftsman's working instruments, in a handsome plush hand folding case. Besides, I will give you absolutely free, a 20 x 25 inch drawing board, 24 inch T square, a 12 inch role, a supply of drawing paper, two triangles, a French curve, pencils, erasers, thumb tacks, etc. The complete outfit is delivered to you at once. You have them to work with from the very first day.

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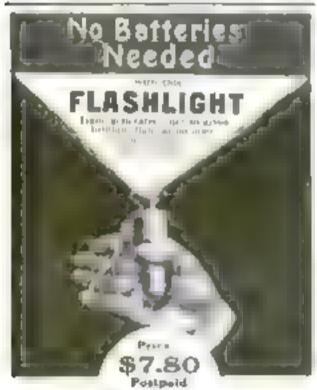
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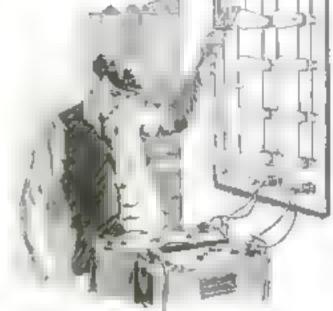
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Building a Simple Charging Panel

By Robert A. Chandler

"HE panel described here will be found very useful for a small garage or for private use. It is easily made and portable, but the electrical fittings must be bought from a rehable house so as to cover underwriters' Pitquirements. This apparatus cannot be used on alternating cur-

Provide the following equipment before starting



Every public garage should have a charging panel. You can easily build one like that shown here

1 drawing-board, 16 by 32 in. or

14-ft. No. 14 rubber-covered wire

1 fuse-block (plug type) and switch double pole, single throw, 125 volts, 25 amp.1

I self-closing box for same, with 4 bushings

4 or more plug fuses, 10 amp. each

4 porcelam cleats

I porcelain knob

2 porcelain tubes, 4 in.

12 lamp sockets

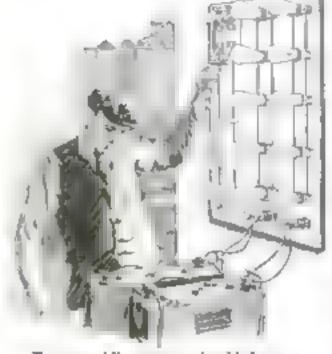
2 connector plugs for flexible cables 2 lengths of flexible cable, one long enough to reach from lamp socket to panel, the other to battery on nutomobile

10 carbon lamps, 100 watta sach (provided by the electric-light company)

Asbestos card or paint, as desired 37 acrews, rubber tape, friction tape, soldering apparatus.

If a drawing-board 16 hy 12 in is available, it will do, but it is slightly

small, If one is to be made, have it at least 18 by 171. should be painted a dead black with lampblack and shellac, as it makes it trying on the eyes. White paint makes a neater appearance, but white enamel gives too great a glare. Some electricians use a thin sheet of asbestos card over the whole surface, as it diminishes the fire risk, but this is



not neat enough. it may be sandpapered with No. OD grade and finished with varnish or shel-BC. Set the fuses next the line, and the awitch so that if it falls due to loose-

not required by

the underwriters.

If the board is

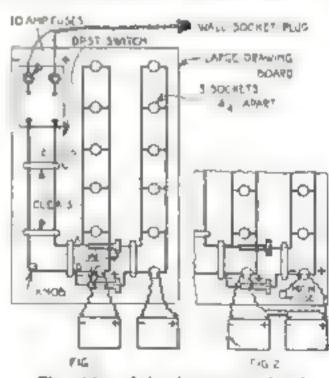
ness of the joints) it will not close a n d CABRO trauble. It must completely covered by a metallic box which closes by

its own weight or by a spring. Where the wires enter and leave, the holes must be bushed. This is to protect the insulation.

Either weatherproof or rubber-covered wire must be used. As the lamps give off considerable heat the weatherproof is best, but the underwriters require rubber-covered wires when they are exposed to acid fumes. If the panel is to be used in a private garage and only occasionally, the weatherproof will pass inspection, but in a public garage none but rubber-covered wire will be allowed. Size No. 14 is the smallest permissible. As it will carry 15 amp, safely, there is ample margin. Where a wire ends at a lamp socket or switch, the end should be turned over to form an eye for fastening

The lamp sockets are of the standard type for house lighting. If a 100watt lamp (32 candlepower, carbon filament) is screwed into one, it allows about I amp, of current to pass. If only 14 amp. is required, an ordinary

> 16 - candlepower 50-watt, carbon filament) lamp can be used, but thm in seldom required, as a variation of 1 amp. is sufficiently close for this work. sure to use carbon lamps, as they permit more current to pass. More aocketa may be added if a greater charging capacity is required. not more than 15 can be supplied by a No. 14 wire. No. 12



The wiring of the charging panel and the proper way of connecting the batteries are illustrated by this diagram.

wire may be used with 20 sockets for supplying 20 amp. of current.

Note that the wires must nowhere come closer together than $2k_2$ in. The cleats keep them at this distance and k_2 in. away from the board. Where one passes under another, a porcelum tube must be used. Tape the ends securely so that the tube will not shift.

The two cables used to supply current to the panel and to connect with the battery should be of the twin type, carrying two wires, and heavy enough to stand rough usage. Twin lamp cord is too light. Each should be provided with a connector plug so that the panel may be moved from place to place as required

Having finished the board to your satisfaction, notify the electric-light company and make requisition for the

Having chosen the lamp socket to supply your panel, follow the line back and note the size fuse on that branch. This is usually 6 amp. If 10 amp. are to be used at the board, and some of the lights burn as well, the fuse will have to be large enough to cover this. Do not use more than 15 amp. on the line, as that is all the wire should carry. After charging, replace the 6-amp. fuses.

Find the Wire Polarity

It will now be necessary to find the polarity of the wires that run to the battery. Provide a tumbler of water and drop a half-tenspoonful of electrolyte into it from the battery, using the hydrometer syrings. This is to make it a better conductor. A pinch of table-salt may be used if it is inconvenient to use acid. Now place the two wires in the solution, keeping the ends slightly separated. The one which gives off bubbles in the acquire and should be left unmarked. The other is the positive, which should be marked in some unmistakable manher—by a piece of tape, string, or a knot tied in it. The polarity should be tested every time the panel is connected to a different socket.

For charging, connect positive of panel with positive of battery and negative with negative. The charging rate is given on the side of battery, as, "Start 15 amp., finish 5 amp.," or whatever it may be. This is obtained by screwing in as many lamps as required. Those that are passing current indicate it by lighting up, so that we have an easy way of knowing the rate as which the battery is charging. If the cells bubble over, we unscrew a lamp at a time and reduce the charge.

If two or more batteries are to be charged amultaneously, they must be connected in series (positive or negative). Then the positive of the enbattery is connected with the positive of the panel, and the negative of the battery at the other end is attached to the negative of the panel. If the two are to be charged at different rates, the two banks of lamps can be connected with them as shown in Fig. 2.



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By GILBERT TOWNSEND, S.B.

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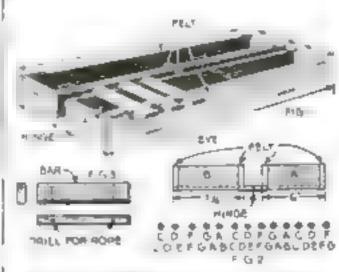
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Your Choice Make a Xylophone in Your Own Home

IF you like xylophone music, it will pay you to make such an instrument in view of their present high rost. The frames must be made first. Use hardwood strips 🦮 in, thick and rut to the dimensions given in the detail diagram. One of the frames is 212 in, high, the other 314 in. Saw the ends at an angle so they may be mitered. Glue a double layer of thick felt lengthwise along the top edges to within 2 in. of each end. The burs are to rest on the feit.

These bars are made from strips of hardwood flooring. Saw off the grooves and tongues from each side of



Make a sylophone for yourself according to directions. Your neighbors will approclate it

the strips and plane them smooth. Bevel the two top edges slightly and round them off with sandpaper. No specific directions can be given for the length of the bars for the various notes as it differs with the kind of wood used. The length of each bar is to be determined by trial. Cut several pieces from 39 ft. to 139 ft. in length and lay them on the felt on one of the frames. By striking them with the handle of a screwdriver you can determine their pitch, comparing each tone with the corresponding note on the plano. If the tone of the bar is not entirely true, it must be tuned. Planing off the ends raises the tone. If the tone is too high, tune it for the next higher tone on the piano. Label each bar properly tuned with the note it represents. Cut enough of these strips or bars for the 32 notes of the instrument, which has a range of two and a half octaves. Figure 2 shows a autable scale of notes for such an instrument. The high G corresponds in pitch with the highest G on the piano.

After all the bars corresponding in tone with the white notes on the piano are cut, lay them on the lower frame in their consecutive order, space them evenly, and arrange them so that the distance between the notes will be the same on the whole frame. Now, with a long straight edge, draw a line along all the bars, above the middle of the pieces composing the frame. Make a punch mark in the frame halfway between the bars and insert a screw-eye in each hole capable of holding a ¼-in.

rope. Remove the bars and drill holes through each bar to correspond with the lines marked on them. Replace the barn and fastening a mees of Man. rope to one end of the frame with a couple of staples, string the rope through each bar and acrew-eye.

At the end of the frame turn to the other side and fasten the bars on the other side in the same manner. Next. set the other frame aide by side with the one already completed, place on it the bars corresponding with the black notes on the plane in their respective order, and fasten them just as the bare representing the white notes were fastened. Then turn both frames face down and connect them by strips, 16 in. by 2 in., so that the bars of the second frame overlap but don't touch those of the first. Cut these strips with the saw halfway between the two frames and connect them by hinges. The instrument can then be folded and is easier to carry.

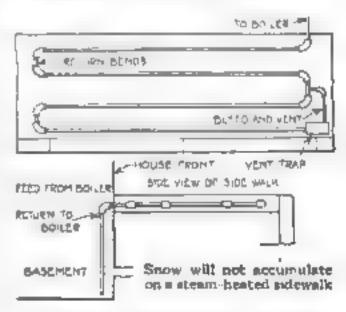
Varnish all woodwork, which will improve the appearance and durability of the instrument. Mallets for playing the instrument may be made by drilling holes in two wooden parlorcroquet balls and inserting a wooden handle in each. If you wish, you may obtain hard rubber mallets intended for this purpose at any near-by music-

store.—CARL CRASE.

Steam-Heated Sidewalks Will Clear Snow Away

URING the winter senson, especially when there is heavy anowfall, a steam-heated aidewalk will save a great deal of time, labor, and expense which would otherwise be necessary for removing the snow.

As shown in the illustration, the steam-pipes are laid in the cinder-bed



of the eidewalk before the concrete is put on. The more coils, the better it The pipes should be of galvanized iron.

The bleed and vent traps do not necessarily have to be in the sidewalk. but may be placed in the basement, connected with the pipes by the bleedpipe, and provided with an air-valve to release the condensed water and air.

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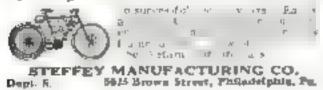








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Correcting a Defect in an Automobile

AUTOMOBILE owners may gain a A valuable suggestion from the description of the method I used in correcting a defect in the coupling of an automobile.

The car was equipped with plain disk couplings with leather insert, which connected the generator with the pump on one hand and the magneto on the other. We found it practically impossible to keep the back lash out. Thereupon we took two mient chain-gear wheels and cut these in two, placing



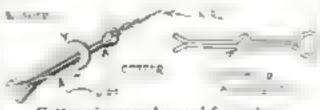
Silent chain-gear wheels, sawed in half and coupled by chain, corrected a defective coupling

each half on its respective shaft and placed the chain around the two halves. The chain, after being connected, holds the two halves of the wheel together and acts (to some extent, as a universal joint, at the mine time making a much finer adjustment for the timing of the magneto-

We have tried these couplings out for five thousand miles, and there is not the least bit of the lost motion that is usually to be found in other couplings.—H. R. SPENCER.

Electric Wires Connected with a Cotter-Pin

WHERE electrical connections must be made and remade in wires carrying relatively small currents, the ends of the wires may be slipped through the loop or eye of the cotter-pin-soldered and twisted to make good contact, and taped. Wireends thus equipped may be quickly



Cotter-pins may be used for making wire connections

attached to other wires, to bindingposts, or to each other by simply slipring the fork of the cotter-pin over the wire and sliding the washer forward to lock it

Wire ends so equipped may be used and reused without becoming frayed,

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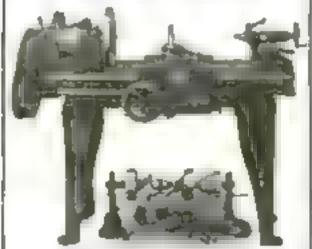
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Gunpowder for Removing Heavy Bolts

RECENTLY a large manufacturing concern had occasion to dismantle a heavy gas-engine, having a flywheel some 30 ft. in diameter. The tearing down of the engines proceeded without unusual difficulty until the



The gun for removing heavy bolts and the recoil cylinder are here shown in working position

flywheel was reached. The sections of which the wheel was formed were separated, after some little difficulty, by heating the large keys which joined them until they expanded sufficiently to be driven out. But the real trouble was found in removing the bub-bolts of the wheel. These were 214 in. in diameter, and from 12 to 18 in. long. Many years of operation in a damp and dusty place had so comented the bolts in place that they resisted the best efforts of a 30-ton jack which was provided for the purpose. After some delay, a 100-ton jack was obtained, and further attempts were made to dislodge some of the bolts by the use of the heavier jack in connection with



The further of the two cylinders is the gun which blew out the bolts, the nearer cylinder provided backing to take the recoil

the 10-ton electric crane which formed part of the power-house equipment. Again failure resulted; a few of the bolts yielded, but the longer ones in the inner circle around the hub refused to budge.

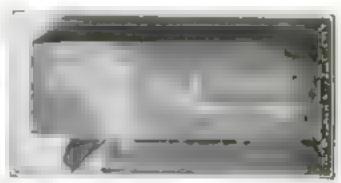
In the extremity, some bright exservice man remembered the damage which can be done by the mortar type of artillery, and proceeded to build a gun. Obtaining a piece of the shafting used in a similar engine, about 10 in in diameter and 4 ft. long, he bored out a hole slightly larger than the diameter of the bolts and extending some distance inward from the center of one end of the steel cylinder.

Near the end of the large hole, a small hole for a fuse was drilled in from the side. In one of the illustrations a aliver of wood is set upright in this fuse hole to show its position.

The other piece of shafting shown in this picture was set up behind the gun to take the recoil, and the gun was set with its muzzle directly against one of the bolts to be blown out.

In the first attempts the gun was loaded with dynamite, and a small section of shafting was used as a plug or "solid shot." The result was that the first gun used was blown in two. One of the illustrations shows the remains of this exploded gun. (The fuse hole does not show, as it was in the half which was blown off.) It was also found that the use of the steel plug was impracticable, as it damaged the metal of the flywheel.

Using the gun shown with a charge of black powder and no plug or shot whatever, all the bolts in the flywheel



The use of dynamite in this gun blew it in two; to avoid this it was found necessary to use, justead, ordinary black powder

hub were finally loosened to a point where they could be pulled out by the heavy jack; a few of the bolts were blown clear out by the force of the explosion. A few days' work, guided by a little military experience, thus avoided the tedious and highly expensive alternative of drilling out the large bolts.

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The alcohol employed in removing the first oil is of course preserved for diluting the oil used in preparing the next sheet.

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Published February, 1921

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Popular Science Monthly 225 West 19th Street, New York How to Straighten a Bent Connecting-Rod

COME time ago a serious accident In the engine-room of one of our local cotton-mills caused the stoppage of the machinery and temporarily made the three thousand employees of the mills idle. The crosshead pin became obstructed and this caused the buckling of a large steel connectingrod of great weight. The rod was 18 ft. long and near its middle, where it was bent, about 10 in. thick. The straightening of the connecting-rod by machinery was out of the question because the mills had no machinery of adequate size and power to do the .work.

In the yard of the factory we built a forge from bricks, leaving a gap at one end to admit the connecting-rod. We built a great fire, loaded the connecting-rod on a truck, rolled it to the forge, and placed it with the bent part in the fire.

Four hours later we took the rod out of the forge, placed one end of the rod on the ground, and lifted the other end with our yard derrick about 6 ft, from the ground. The raised end of the



Heated at the bend, the connectingred was dropped on the ties

connecting-rod was held by a grass rope close to the end. We placed two railroad crossties on the ground beneath the bend and with a steel hook shipped the rope of the end.

Three falls of the rod, which had to be reheated twice, straightened the bend and, as there was fortunately no torsion, the connecting-rod functioned properly when the engine was started next morning.—J. EDGAR MITCHELL.

Temporary Patch for a Torn Automobile Top

HERE is a good method for mending a torn automobile top. Sew the torn edges of the tear together with stout thread. Then take several strips of surgeon's tape and lay them over the joints, pressing the tape down solidly and warming it by the heat of the hand.

When the tape is firmly stuck to the top, give it a couple of coats of shellac and allow it to dry thoroughly.

Lastly, give the tape a coat of quickdrying paint, the color of the top, and the repair is completed.



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An Electrical Automatic Recording Target

By Clifford A, Butterworth

T'HE construction of an electrical automatic recording target for a rifle-range is detailed in the accompanying illustrations. In operation, the spot where a bullet strikes is instantly indicated by the lighting of a lamp in a corresponding position on a signal-board, making it easy

to correct the aim and keep account of the acore at ranges at which the target cannot be easily seen.

The target is composed of five rings, each of which is divided into four sections. Each section is fastened to two arms which swing on a pivot. The section is normally held out by a spring, but when a bullet strikes, it swings back under the impact, pushing in a switch plunger which closes the contacts on the back of the target panel, lighting a lamp on the signal-board.

As the size of a target depends entirely upon the range at which it is to

be used, this is left to the constructor. The dimensions given are for a target approximately 8 in. in diameter. If the target is increased in size to any great extent, the parts must be made heavier in order to have sufficient strength.

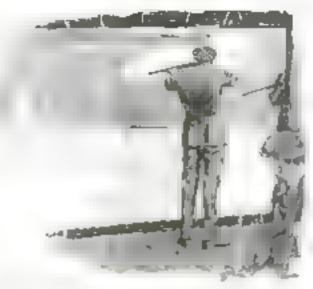
In making the target a wood panel is first built up, being made about 16 m. square. To this is

bolted an iron plate of the same size, if in thick. The acrews that hold on the working parts can be tapped into the plate, or bolts can be used and run clear through the wood.

The target rings are cut from 1/4-in. plate, turned to size and then cut into

sections. They are drilled and countermink for the 3 16-in, bolts fasten that them to the The outside diameters of the rings are as follows Outer ring, 8 t in.; second ring, 61/4 in; third ring. 412 in fourth ring, 3 in.; fifth ring, 11, in.; bull's-eye, 🤾 m.

The arms are shown in detail



Shoot at the target and electric lamps will agnal automatically where your bullet struck

in Fig. 1. They are made of 3/16 by 34 in flat iron. They swing on a Sain, pin. The spacing rings that keep them the proper distence apart are cut from 3, 4h. pipe. The switch plungers are made of Jgin. ateel rod. The ring sections are fastened to the arms as in Fig. 2. The spacers, which are placed

between the sections and the arms, can be cut from \$4-in, pipe or washers can be used. The space between the ends of the bolts and the plate must not be more than 1/2 in. The arrangement of the bull's-eye and the four sections around it is shown in Fig. 3. These five plungers are made of \$4- instead of \$1/4- instead of \$1/4- instead of \$1/4- instead.

The five small plates on the back of the panel which provide a bearing for the inner ends of the awitch plungers are arranged as in Fig. 4. The holes in the panel must be large enough so that the plungers will not touch the

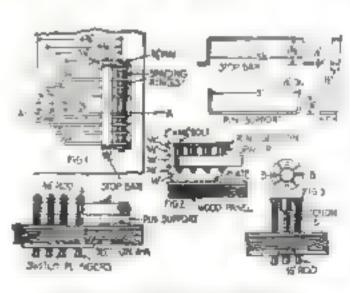
wood, as they must work as easily as possible. The best way to do is to mark the places for the plungers on the front plate, and after boring the holes in the wood and fastening the plates on the back, drill the plunger holes through both plates at once. This will insura perfect alinement.

The arrangement of the contacts is also shown in

Fig. 4, and an enlarged view of a contact strip in Fig. 5. The strip is placed so that a contact is made when the plunger has moved in about 1/2 in

The wires from the target to the signal-board are connected as shown

in the wiring diagram. A wire is run from each contact to the lamp in the corresponding position on the signal - board. One battery wire makes connection with all the lamps, and the other is connected with the plate on the target panel. Altogether there are 22 wires runming back from



Detail of the con-

struction of the

target is shown here

These erose-sections and diagrams of the different parts of the target will be of help to you in making such a target



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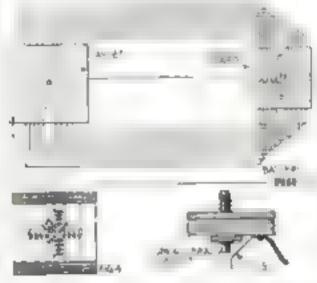
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the target. They can be bunched together like a cable and bound with tape every few feet.

The signal system can be improved by the maker if desired. For example, the wires from the target, instead of being connected directly to the lamps, could be connected to electromagnets operating small switches, so that a lamp on the signal-board, instead of only flashing an instant, would remain



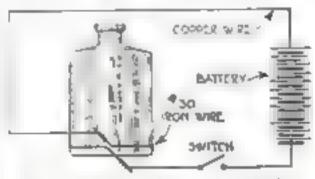
The complete wiring diagram of the target and the construction of the electric contacts are here shown

lighted until the switch was released. It would also be possible to construct an automatic recorder with electromagnetically controlled pencils to mark the score on paper moved by clockwork.

Cutting Off the Bottom of a Bottle

T is sometimes desirable, especially I in a laboratory, to cut off the bottom of a bottle and to do so with a clean-cut fracture.

The accompanying diagram shows n very effective method. Tightly draw about the bottom of the bottle a piece of No. 30 Iron wire, carrying one end to one pole of a battery and the other end to one binding-post of a kmfe-switch. Do not allow the ends



When the current is sent turous wire, its heat will cause the bottle to ernek.

to touch at the point on the glass where they cross, and draw them tightly. Connect the other bindingpost of the switch and the battery with ordinary copper bell wire.

The source of current may be a dozen dry cells, or with a suitable resistance in series, current may be taken directly from the house-lighting circuit. Upon closing the circuit, the heat in the wire causes the glass of the bottle to crack in a smooth line.



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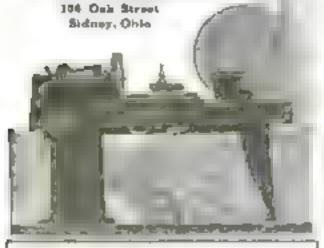
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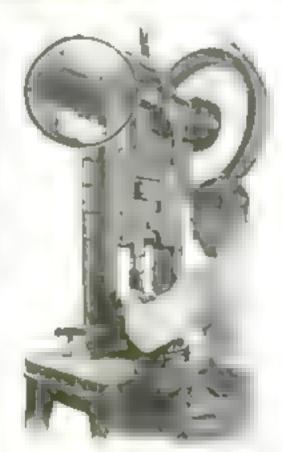
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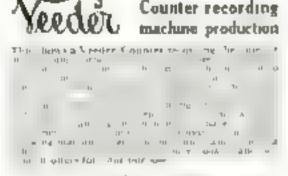
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Why Some Lathe-Work Is Inaccurate

By Howard Greene

FTEN the amateur mechanic finds that when a piece of turning is finished it is not as accurate as it should be, though the lathe may be of a good make, the tools in good order, and the actual turning curefully done. Perhaps the commonest fault found is that, in the case of a shaft or other somewhat long piece, the diameter at the tailstock end will be greater than at the headstock end. The reason will be found in the fact that the cen-

ter for the tailstockend has not been properly prepared.

A center-mark is made with a center-punch. the lathe center jabbed into it, and the work proceeded with. As the work goes on, the center. finding itself in a place in which it does not fit, gradually wears itself into the metal. As the recess gets larger. the shaft becomes loose between the centers and shifts away from the tool

Not only does it shift more and more as the work proceeds and the receas becomes larger, but the nearer the tool comes to the dead center, the greater is the movement. And if the mechanic, noticing the looseness. tightens up his back center, the resu't will be a change in the cut unless the tightening in done between cuts.

The proper thing to do is to prepare a proper center in the first place. Drill a small hole in the center of the shaft; 1/16 in. is a good size for small work. Drill it far enough so that the point of the center will not reach to

the bottom. Then make the seat for the dead center with a regular centering tool or a drill ground to the 60° angle of the center, or with an old center with flutes cut on it as shown in the illustration This gives a bearing for he center that will hold the work properly, though it is always well to try between cuts and see if any

shake has developed. The small hole first drilled not only protects the point of the center, which should never touch the work, but also holds a little extra supply of oil for lubrication. While the centering of the other end of the work is not so important, because there is no relative movement there between the center and the work.

it is best to treat both ends the same

Another cause of annoying inaccuracy in lathe-work is back-lash in the cross-slide. If the work is done with an eye wide open to this possibility trouble can be usually avoided. For matance, if the tool has been fed in and the mechanic finds it has been advanced too far and turns the handle back a little, if he is not looking out. the result may be a backward jump

> until the backlash is taken up and a consequent involuntary alteration in the adjustment occurs. The proper way, under the circumstances, is to back off the tool a little and then feed it up again so that there will always be pressure from the acrew to remut the push from the tool. Watch an experienced lathe-hard and he will work this way almost invariably, constantly on his guard against

Careful gaging will disclose inaccura-

cies if the work is not properly centered

trouble as a matter of fixed habit.

Do not start a job without oil at the cutting-point and then later on start the oil running. It will alter the cut. On the other hand, if you start the oil, keep it up to the end of the cut. Use the same cutting lubricant from one end of a cut to the other if accuracy is called for.

It is a common thing to use a filesmooth cut -- for getting a smooth finish on a rough-turned job. This is all right in some cases, but it is bad business unless accuracy is a minor consideration. It is practically im-

possible to file evenly enough to avoid taking off more in one place than another, and the work wal he more or less out of parallel and out of round. But if only finish is the object, it will do we l enough. Never hold the file still while the work runs under it. Keep it moving, not only across the work, but lengthwise.

or you will get scratches and grooves and the file will get its teeth filled up very rapidly. In rome work a very fine finish can be obtained by using a bit of oilstone and oil on the surface.

The amateur working on the lather should always bear in mind that accuracy is the most important thing and fine finish is of only secondary consideration.

CENTER O, TIER

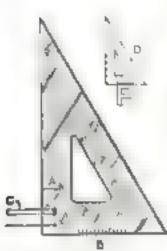
A good center and

the tool for cutting

Increasing the Usefulness of the Triangle

THE usefulness of a triangle such as is used by draftsmen may be increased by a simple method without marring it in any way. Drill 3 small holes as indicated in the accompanying drawing about 1/4 in, from the edge of the longer right-angle side.

When you wish to do some lettering,



Mark your triangle thus If you do much lettering

you can draw guide-lines by placing the point of the pencil successively into the 8 holes and drawing the lines by sliding the short side of the triangle along the edge of the T-square, Without any measuring the size of the lettering will be uniform.

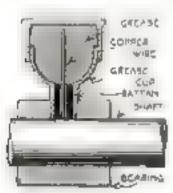
If you mark out the proper

distance, and draw a line as shown at A. it will help you to get uniform spacing between the lines of the lettering. The scale marked at the short edge of the rectangle will enable you to mark off the guide-points for the vertical lines of block letters as shown at D in the upper corner .- J. H. Moore.

For Oiling Line-Shafting Bearings Automatically

IN small workshops where no mill- wright is employed, line-shafting is quite frequently neglected and al lowed to go without proper lubrication. If the bearings are equipped with grease-cups, as shown in the illustration, they will run for a considerable length of time without attention.

A small length of rattan is driven into the nipple of the cup as shown. Through its center is drilled a hole of a diameter large enough to accommodate a piece of copper wire and leave



Off your bearings? well and avoid trouble

a small clearвисе. A piece of copper wire is placed as shown, one end touching the shaft, the other protruding into the greasecup.

The greasecup is filled in the usual way. As the bearing warms up with

the friction of the shaft's turning, the copper wire, being in contact with the shaft and a good conductor of heat, warms the hard oil in the cup enough to allow some of it to flow down to the bearing. The warmer the shaft becomes the more oil is fed to the bearing. The wire, being softer than the shaft, does not scratch or cut the shaft.

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Gymnastic Apparatus for Your Yard

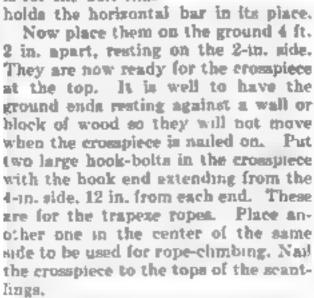
By Walter S. J. Thompson

THE apparatus shown in the illustration comprises the horizontal bar, flying rings, trapeze, and a child's swing, while rope-climbing can also be practised upon it.

The uprights are two scantlings 2 in. thick by 4 in. in width and 15 ft. long. The crosspiece at the top is a piece of the same material 4 \(\frac{1}{2}\) ft. long. These can be purchased in a lumber-yard.

Put the scantlings together with the 2-in, sides facing each other. Then measure up 3 ft, from one end and mark with a pencil. This length goes into the ground. Measure up 6 ft. from the 3-ft, mark and mark again. Now mark every 6 in, for a distance of 2 ft, each side of the 6-ft, mark These are for the holes which the hori-

zontal bar slips through. Thentake a brace and bit 🛨 and hore a hose to h 16 Gameter in the middle of the scantling at every 6-in. mark. Then turn the scantlings an the 4-an, sides are together and in the . nuddle of the 2-m side on both wantlings, draw a line from the first hale to the last and bore a 1,-in, hole all the way through the scantling so it will pierce the center of every large hole. Do thus till every hole is pierced. Thus is for the bolt that



Now give the whole structure a coat of white lead and two or three coats of any color paint desired. While the paint is drying, select the spot where you wish to erect the apparatus, but be sure you have room enough for the trapeze and swing. Dig two square holes 1 4 ft. square and 3 ft. 4 in. deep. The scantlings should be in the center of the holes and there should be 4 ft. 2 in, between them.

When the paint is dry, mix the coucrete. One part cement, 2 parts sand, and 3 parts stone. Mix it thinly and put 4 in. of it in the bottom of the hole, then set the scantlings in place and put the concrete around them. Keep the scantlings vertical by stays while the concrete is soft. It will take about a month for the concrete to harden, during which time the scantlings must not be touched.

A piece of oak pole 4½ ft. long and 1½ in. in diameter is best for the horizontal bar. Run the bar through the lowest hole in one scantling and through the corresponding hole in the other scantling, and if the bar is not even with the outside of each scantling, it should be sawed off so it will be. Take a bit 1¼ in. in diameter and shove it through the small hole in the scantling and bore a hole through the

horizontal bar. Be sure to hold the bit horizontal or else it will not come out through the hole in the other scantling. Now purchase 2 bolts 41½ in, long, these are to shp through the small hele in the scantling and in the horizontal bar to keep it firm while it is being used

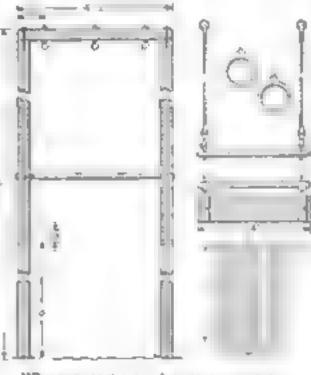
The trapeze-bar is made from the same material as the horizontal bar, but it should be 34 in, long. Bore two ho as 1 1/4 in, from each end. Purchase two bolts like those

shown. Run these through the holes and tighten the nuts. It is well to wire the bar each side of the bolt with copper wire to prevent the bar from splitting. Now purchase a piece of manila rope 14 ft. long. Cut it in two equal parts. Now hay two safety-hooks such as shown in the Pastration, pass one end of the rope through and splice the rope for a distance of 6 in. Then wind it tightly with strong fishing-cord. Do the same to the other hook. The other end of the rope is passed through a ring and wound.

The seat for the swing is the same length as the trapeze-bar and about 1 in, thick by 8 to 10 in, wide. Nail two cleats, one on each side of the seat, as shown in the illustration. Bore a hole at each end for a bolt. The same kind of a bolt in used as was used on the trapeze-bar.

The rings can be purchased in a sporting goods store for about one dollar apiece; the rope may be obtained at any hardware store.

Instead of having an extra piece of rope for rope-climbing, the two short lengths can be joined together, thus reaching the ground.



Why not erect a combination apparatus like this in your back yard?

Mailing-Tubes Used in Making a Spy-Glass

SATISFACTORY spy-glass can be made of two mailing-tubes and two lenses in a short time.

Procure two ordinary mailing-tubes about 114 in. in diameter and 15 in. long, that will slide, one within the other, fairly anugly. In one end of each tube, about 1 in, back from the edge, put a shoulder of thick cardhoard around on the inside, fastening

for the end of the tube should then be made of a tin-can cover that slips over the end of the tube and has a hole cut in the center. A convex lens is used in the objective or large tube and a concave lens in the smaller one.

Blacken the inside of the tubes if possible with a mixture of lamp-black and turpenting.

The length of the tubes depends upon the combined focal length of the pair of lenges, but any optician will tell you just what leases to buy

Give the outside of the tubes a conting of shellac to protect them from the weather and your spy-glass is done.

By extending the tubes or pushing them together the proper focus can be quickly obtained. - L. B. Robbins.

A Homemade Handle for Your Automobile Battery

PVERY one using a storage battery in his automobile will have to lift ft in or out occasionally. This invariably necessitates the use of both hands and considerable exertion, as the

*WENESS

SMAP

BATTERY

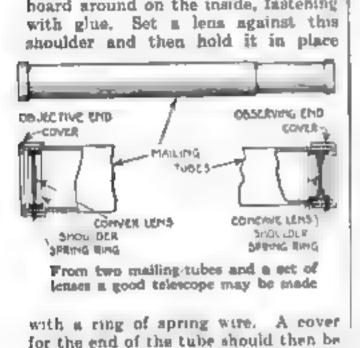
Make your work ensist

with this bettery handle

battery case is bulky, heavy. and hard to handle.

A very useful device for lifting the battery can be made by fastening a harness spap with rivets to each end of a stout leather strap of

sufficient strength to support the weight of the battery. Such a handle makes it much safer and easier to move the heavy weight, and meures the battery against injury due to breaking one or more jars.—RONALD L. PRINDLE.



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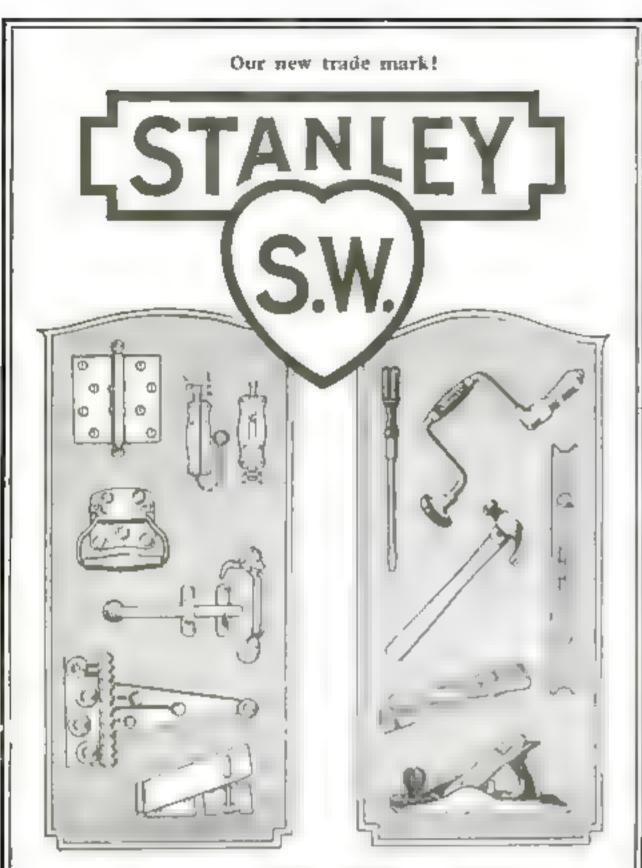
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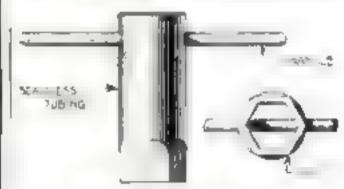
NEW BRITAIN, CONN.

New York Change n Francisco

A Wrench that Is Made of Seamless Tubing

A SOCKET-WRENCH is always a handy tool about a shop or garage, and at times it is indispensable. One that fulfills all the requirements of the purchased tool can be made easily.

The wrench shown in the illustration was made to fit the head of a \$10in. standard cap-acrew with hexagon head. A piece of \$\frac{1}{2}\$-in, seem ess tub-



Key-wrenches are passly made of seamless tubing

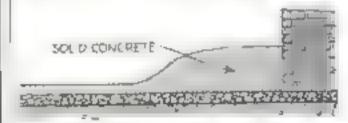
ing was procured and the head of an old cap-screw ground to a taper. The end of the tubing was then heated and forced on the head. After heating again, the socket end of the tubing was forged about the head of a \$\frac{1}{2}\end{2}-in. cap-screw. The shank end of the wrench was drilled for a piece of \$\frac{1}{2}\end{2}-in. drillered, which was used as a handle.

By using various sizes of tubing, a complete set of wrenches may be made for either hexagonal or square heads. The shanks may be forged to fit a handle which is interchangeable with the complete set. If there is no seamless tubing to be had, iron pipe may be substituted, although it does not have the lasting qualities of the tubing.—Lowell R. Butchen

To Make a Cement Bumper for the Garage

To prevent running the automobile through the back of a closed garage, a cement bumper can be built either when building the drive and cement floor or years later. This is done by making a hill of cement about 16 in high and starting the incline about 3 ft. from the wall.

Before constructing, examine the front end of the automobile to see



Solid concrete makes a good bumper for the rear of your garage

whether or not it carries a bumper and how high the hill should be built to leave clearance for any front appliances that may be added. The hill should be made just abrupt enough that in the event of the automobile's starting to ascend, it would be met by such resistance as to cause it to roll backward, —J. ALEXANDER.

OPKN-W10-C92R



Constructing a High-Voltage "B" Battery

By Thomas W. Benson

Do you want to make an essily renewable and cheap battery for the plate circuit of your audion? This tells how the writer constructed drycells to deliver 32 volts, at a total cost of about 50 cents.

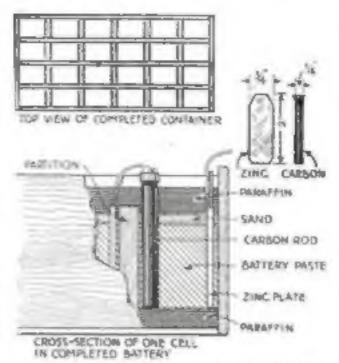
The container was made from a cigar-box partitioned off into 24 compartments by means of hardwood strips 5/16 in. thick and 1% and 1% in. wide, respectively. The wide strips run from end to end of the box laid on edge. The narrow strips are cut into 1%-in. lengths, 20 of them being required. The ends must be cut square with a miter-box.

One side of the cigar-box is removed. The remaining corners are nailed tight with %-in, brads. The box and strips are then boiled in parassin, and while the parassin is still soft are assembled in the box. Only the longer strips are fastened with brada; the others are wedged into place. The side of the box that was removed is now nailed in place. Melted paraffin is poured into the cells to a depth of 1/4 in. This seals the bottoms of the cells and helps retain the strips. Any cracks that appear at the joints can be sealed by passing a hot iron over them.

The container is then tested. Fill the cells with salty water. Connect a telephone receiver and battery in series, and dip the ends of the leads into adjoining cells to determine whether there is a leakage. To remove any short circuits use the hot iron as before.

No. 6 dry-cell, cut off its zinc shell and

To assemble the cells, take a new



It costs very little to make a high-voltage battery like that described here

remove the black substance inside. Add to it half as much flour and sufficient 10-per-cent sulphuric-acid solution to make a thick paste.

The sine shell is flattened out and cleaned with sandpaper. It is then cut into 24 pieces measuring ¼ by 2 in. The corners of these pieces can be trimmed off as shown, if desired. For the carbon elements use sticks 2 in, long and ¼ or ¼ in. In diameter. These can be obtained from old pocket-light batteries or from the B batteries at present on the market. They have brass caps fitted, and serve the purpose nicely.

The prepared mixture is distributed evenly among the cells, taking care that none gets on the top of the partitions. Put a carbon stick and a zinc sheet in each cell. The zincs, however, are wrapped in porous paper toweling or filter paper for 1½ in. of their length. Double a piece of paper 3 by 2 in. the long way, insert the zinc between the folds, and turn back the ends. The zinc can then be pushed into place. The wrapping prevents local action of the zinc. Each cell gives about 1.3 volts. On short circuit it will give 0.5 ampere.

When the elements are placed, cover the paste with clean sand nearly to the top of the partitions and pour in paraffin to cover the cells and partitions. After the paraffin has hardened, the cells are connected in series by short soldered leads from the sinc of one cell to the carbon of the next. Bring out leads as desired. When the connections are completed, more paraffin may be poured in. The box may be painted and the lid replaced to give it a finished appearance.

Should the voltage drop off after several months, it may be brought back temporarily by inserting a heated nail through the top paraffin and injecting a solution of sulphuric acid.

When finally worn out, the battery may be completely rebuilt from one No. 6 dry-cell. Simply disconnect the zinc terminals and pull out all the electrodes with a pair of pliers after warming the battery slightly. Scrape out the paraffin and remove the dried pasts. The new pasts may be put in, the old carbons used again, and new zinc sheets inserted. The paraffin may be melted over and used again. The cost of making and maintaining such a battery is extremely small.

How to Make a Good Fishing-Pole from a Cheap One

By Frank W. Harth

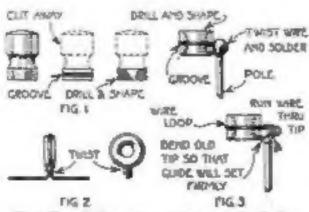
EVERY fisherman takes particular pride in his pole with agate line-guides, etc., if he is fortunate enough to own one. But a pole so equipped costs considerable money.

The illustration clearly illustrates how a cheap fishing-pole, equipped with only simple wire guides, may be converted into an efficient and satisfactory pole with guides that are every bit as good and work just as well as the expensive pole.

The operation of converting one to the other is simple, but takes a little time and patience. To remove the guides from the old pole take a pair of pincers and unwrap the wire which assists in holding the wire guide in place. If the solder that is left still holds the guide firmly, it can be removed by placing the guide over a torch flame, or even an ordinary gasstove plate will do. Be careful not to remove too much of the solder, as the amount which is left will serve as the

tinned surface to which to solder the new guides.

The new guides, instead of being made from expensive agate, are turned from acrap ivory knobs taken from an old electric instrument. Figure 1 shows how the guides were made. A lathe is not at all necessary, in fact, a good knife and file are all the tools that were used.



Details of the accessories required for converting the cheap pole into a highclass one The guide-holders are made from paper-fasteners straightened out, wrapped once around the groove in the guide, and then twisted, leaving two ends for soldering. Figure 2 shows the holder loop in detail.

By holding the wire in place on the pole with a pair of pliers, one end can be soldered into place. After one side is soldered, the finishing of the other side is a simple matter. The superfluous lead is then trimmed off with a knife and file.

The tip was made in the same way, except that the other end of the knob was used.

Figure 3 shows how the tip was fastened and then soldered into place. It is not necessary to wrap the wire on again, as the guides will hold just as well.

The rebuilt pole, although not as fancy as a professionally made pole, looks fairly well and, what is more, works just as well.

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Drawing on Fungus-a Novel and Pleasing Art

By Anthony E. Zipprich

THE fungus is a form of plant life with the uses of which comparatively few people are acquainted.

One class, popularly called shelf or bracket fungus, may be used for decorative purposes. Pictures may be drawn on its flat surface. The bracket fungus is found most often in the shape of a semicircular bracket, varying in size from 1 in. to 2 ft. in diameter and attached to dead stumps and fallen logs—beech-trees particularly.

One side, the upper, is a hard woody surface, brown in color, with concentric rings similar to the year-rings of a tree. The under side in most specimens is a pure white which, on the slightest rub, becomes a sepia brown. It is this side on which the artist can work.

In fungus-hunting, which is fun in itself, the artist needs but few materials—a chisel to pry off the brackets, a



The largest and whitest fungl may be found in the thickest and darkest woods

hammer, and some receptacle to hold the specimens so that their sensitive white surfaces do not rub or touch one another. A box with several shelves and a handle for carrying will answer.

To obtain good, untarnished fungi. it is necessary when chiseling them from the log or stump to make sure that the bracket comes off without breaking and without falling to the ground. If this should happen, as is sometimes the case, and it falls on its white face, the specimen is spoiled.

Having a few good specimens, the artist is ready for his work. A simple set of tools is now necessary, consisting of three or four sticks sharpened to various degrees of fineness and a clean rag. A stylus and the file blade of a pocket-knife are even better than the sticks. One of the sticks should be sharpened to a flat chisel point, which tool can be used to secure background and shadow effects.

When the artist has determined on his sketch, a portrait, landscape, building, or a copy of a picture, he must remember that a mark once placed upon the fungus cannot be erased. A misplaced line or badly proportioned object cannot be rectified.

The reason for this is simple. The



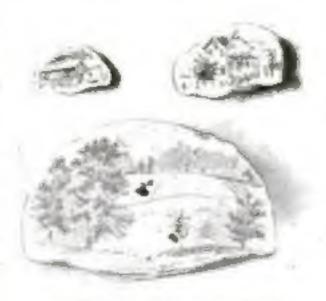
Highly pleasing artistic effects may be produced by etching portraits on fungi

"etching side" of a fungus, when freshly picked, is very slightly moist and pure white. This white surface, however, is only about as thick as paper. Directly beneath it is the body of the bracket, a rich deep brown, exactly the color of the photogravure pictures in many Sunday newspapers. The scratch of a pin or the cut of a knife will expose this beautiful brown underneath, leaving a permanent mark.

The exactitude required is precisely what fuscinates and makes the art alluring.

An artist in making his first attempt will do well not to block in his subject, but rather to make smail dots on the white surface at important parts of his composition, which points can then be connected. The proportions and outlines are then sure to be correct and true in perspective. The technique of the artist and his method of handling will be greatly enhanced in consequence.

To keep the lines of the subject clean and sharp, a linen rag should be alongside of the worker. In the process of etching, the tool gathers up small parts of the white material, and as a crisp, sharp line is hard to get with a clogged scriber, it must be wiped on the cloth after every line. When this is done, no



The velvety white under side of the lungus offers an excellent medium for the artist's stylus

specks or crumbs stick to the picture and the results are more satisfactory.

Fungus etching will give keen delight to any individual skilled in the use of the pen or engraving tool. It has, or may seem to have, serious drawbacks when one is not well acquainted with its peculiarities. One of these drawbacks is the tendency of the fungus to dry up and become unworkable, sometimes within twenty-four hours. However, a dried shelf or bracket can be put in working condition by placing it in a damp atmosphere overnight or by hanging a damp rag over it. The time required for this varies and is only learned by experience.

The tendency of fungi to dry and become hard should be kept in mind and only so many brackets should be collected as an artist can conveniently etch in the course of one day.

A second and also a serious difficulty relates to the color of the working side of a bracket. The finest and whitest specimens are found in the deepest woods where little or no sunlight penetrates. When they are brought out in the daylight, some turn a light brown or pink after several days. To prevent or lessen this, they should be stched only in subdued light, or, if this is not feasible, they should be left in the sun



Great care must be exercised to prevent the fungi from becoming marred by scratches

no longer than the time required to finish the sketch. With the picture completed and the fungus dried up, the tendency to "yellow" will be largely lessened.

As stated at the beginning of this article, effects like the mezzotints of the old English masters can be secured; wood-engraving and charcoal studies likewise have their counterparts in the fungus medium.

The water-colorist will find the white surface of hard and dry unused fungus a very fine medium for his brush. While the writer has never attempted oil-painting on them, it is within the range of possibility that this form of the graphic arts can also be successfully applied to fungi, but etching seems, after all, the most logical and appropriate method of utilizing fungi for artistic purposes.

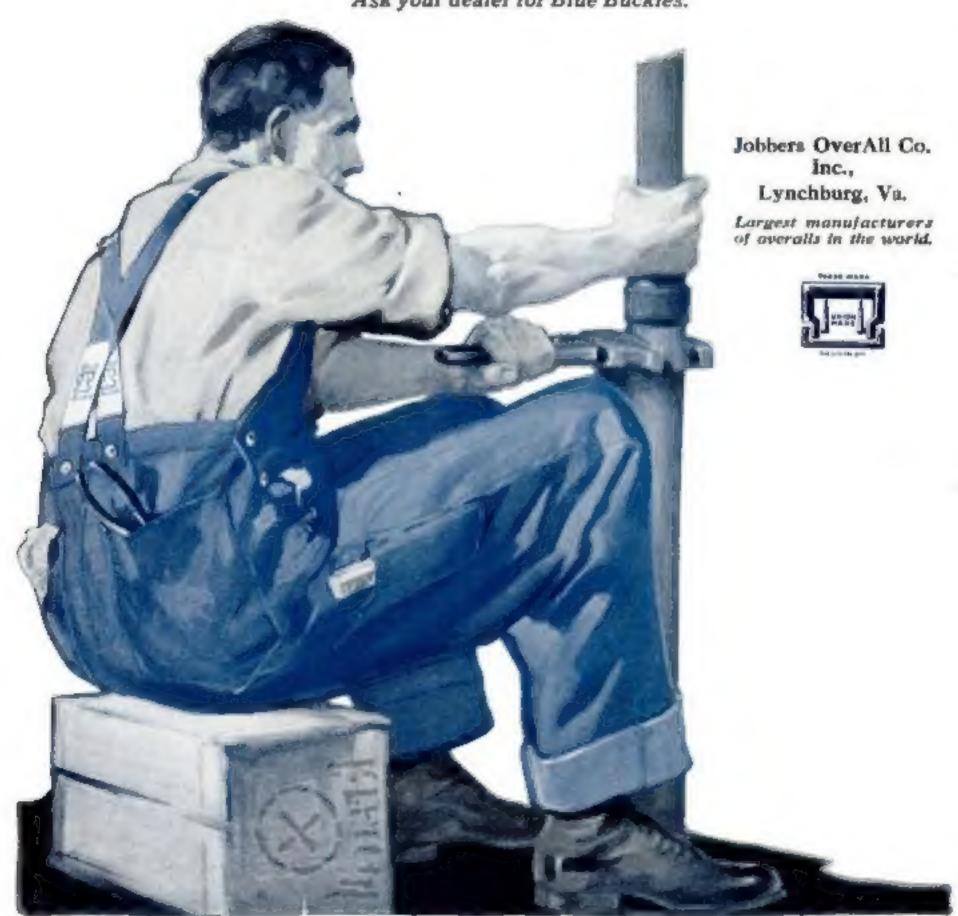
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